A resumé of the ACADEMIC and SCIENTIFIC CAREER

Prof. Dr. MIGUEL ÁNGEL ALARIO y FRANCO

Professor of Inorganic Chemistry (Solid-State)
Honorary Emeritus Professor at
***Complutense* University of Madrid**
(UCM)

Madrid (Spain) 22-9-2022
Curriculum vitae.

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1-Historical Account

Prof. Dr. Miguel Ángel Alario y Franco
(Carabanchel Bajo, Madrid 1942).
Doctor of Sciences, *Suma cum laude*
Thesis: The Porous Texture of Aluminium Phosphate Gels
Supervisor: Prof. Dr. Andrés Mata.
Universidad Complutense de Madrid (UCM) 1970

1-1.-University and scientific positions

Postdoc: London (Brunel University with Prof. K.S.W.Sing), Wales (Aberystwyth University with Prof. Sir John M. Thomas. FRS), Italy (ICTP Trieste, with Professor García Moliner): 3 years in total
Assistant Student of Practical Classes (1965-6) UCM. **Assistant Professor** (1966-8) UCM. **Temporary Assistant Professor** (1968-70) Universidad Autónoma de Madrid UAM). **Demonstrator** Physical Chemistry (UCW Aberystwyth) (1971-73. **Scientific Collaborator**, Institute of Materials CSIC of Madrid (1973-6). **Temporary Associate Professor,** UAM (1973-5). **Full Professor of Inorganic Chemistry** (***Introducing Solid-State Chemistry in the University Curriculum***) Faculty of Chemical Sciences UCM (1976-)). **Head of Department** of Inorganic Chemistry (1985-6). **Dean** of Chemical Sciences (1986-1994) UCM.

Coordinator of Science Courses (1991-95) and ***General Director*** (1996-98) of the **Summer School of the Complutense University** in San Lorenzo de El Escorial (Madrid)
In that particular period, *according to Lord Hugh Thomas,* it was:
"The greatest cultural feast of the European summer".

Promoter and lecturer in all editions of the Course ***"Science for all"*** in the Royal Academy of Sciences of Spain (2004-) currently in its XVIII edition. ***Coordinator*** of the group of Spanish scientists and ***plenary speaker*** at the Spanish-British Tertulias (Spain/United Kingdom) 2002-2015.

1-2.-Visiting Professor / Visiting Scholar/ Professeur Associé / /Directeur de Recherche

Cambridge (United Kingdom) with Sir John. M. Thomas; Grenoble- (F) with Profs. F. Bertaut, J.-C Joubert & M. Marezio; Berkeley (UCB-USA) with Prof. Angy Stacy; Bahía Blanca (Argentina) with Prof. Bazán; San Diego (UCSD-USA) with Prof. Ivan Schuller: 5 years in total. *Professor at the doctorate program*, Lomonosov University. Moscow (1989). America Chair of the Royal Institute of Spain -2 Months in Mexico- (UNAM)

(1996). Professor Emeritus: UCM (2012-). U. San Pablo / CEU- (2013-) Honorary Professor U. Carlos III (2013-4).
Visiting Scientist: Institute of Integrated Cellular Materials, Kyoto University Japan (2 weeks a year 2011-13). Honorary professor at UCM (2016-). Member of the *Free College of Emeritus of Spain* (2015-). Guest Professor, Southeast Univ. Nanjing, China (2021).

Promoter and president of the First Master in Spain in Materials of Technological Interest (1987-89) UCM.

1-3.-Work in Industry

Chemical Analyst at Oy Alkoholilike. Rajamaki-Finland (3 Months-1968).

1-4.-Royal Academies and Societies Membership

Full Academician (1991-), President of the Physics and Chemistry Section (2000-6) and President (IX-2009-IX-2012) of the Royal Academy of Sciences of Spain.
Founder (1985) and ***President*** (1985-1998) of the Solid-State Chemistry group of the Royal Spanish Society of Chemistry.
Honorary Member: Materials Research Society of India (1992-).
Honorary Diploma from the University of Tel-Aviv, (TAU) with UCM (1989).
Corresponding member: Academy of Sciences of the Argentine Republic (2008-), ***Honorary Academician*** of the Academy of Sciences of Colombia (2010-). ***Honorary Fellow*** of the University of Wales, Aberystwyth (2015-). ***Full member*** of (EurASc) European Academy of Sciences (2018-) ***Trustee*** of the Complutense Foundation. ***Director of the Science area*** of the Complutense Foundation. (1991-8)

1-5.-Awards and honours

Prize for young scientists, Royal Society of Physics and Chem. of Spain 1973.
Research Prize, Royal Academy of Sciences of Spain, **1984**. **Research Prize,** Academy of Sciences of Granada **1990**.
Rey Jaime, I Prize on Basic Research in 1991.
Medal of Honour of the Spanish Royal Society of Chemistry **1996. Golden Epsilon** of the Spanish Society of Ceramics **2003.**
México Prize on Science and Technology 2009.
Senior Research Award of the Franco-Spanish Solid-State Chemistry and Physics conferences **2010.**
Miguel Catalán Prize to a ***"scientific career"***, Madrid Autonomous Community, **2010.**
Diamond & Gold Medal of Madrid Association of Chemistry & Chemical Engineering **(2015).**

1-6.- **Some Scientific accomplishments.**

Pioneer, at the international level, in the early seventies, in the development of ***Solid-State Chemistry and Materials Science*** as a ***research activity*** in the Condensed Matter field and as an ***academic discipline*** non-existing in Spain – neither in many other universities at the time.

Innovator in the use of Electron Microscopy & Electron Diffraction in the Chemistry of Solids.

Founder (1974) & **Director** (1974- 2017) **of the Solid-State Chemistry group** Faculty of Chemistry of UCM :https://www.ucm.es/quimica_inorganica/estado-solido. (More than ***~200 visiting scientists***; -40% foreigners in periods of two weeks to four years in 48 years.

Founder of Electron Microscopy Laboratory, Institute *Elhuyar,* CSIC (1976) (later ICMM).

Founder (with A. M Municio y R. G Amado) and **Scientific Director** (1987-1992) of the "Luis Bru" **Electron Microscopy Center,** UCM. Later National Center.

Introductor of Electron Microscopy in 3 French laboratories: Cristalographie- CNRS (C. Chaillout/E.L.Bertaut) Grenoble 1983; INPolytechnique Grenoble (M. Labeau/J.C. Joubert) 1986 & LCS Bordeaux (J. -C. Grenier/Paul Hagenmller) 1990.

Founder (1996) & **director** (1996-2016) of ***Complutense Laboratory for High Pressure***/ http://webs.ucm.es/info/labcoap/index.htm. (Used by more than 15 Spanish and foreign research groups)

Founder (with E. Morán) (1990) and director (2000-2019) of the *"Solid State Electrochemistry Lab"* in the Faculty of Chemistry (UCM). Working in processes of Insertion, Electrodeposition, Lithium Ionic Conductivity... Electrochemical Oxidation-Reduction processes; using materials in the electrodes to modify their structure and properties…

1-7.-Scientific Committees

Member (since 1984) and ***President*** (1992) International Symposium on the Reactivity of Solids (1992, Madrid). ***Member*** International Advisory Panel on Superconductivity (EU). (1988-2000). ***Member*** of the Gordon Research Conferences in Solid State Chemistry Panel (EU 2002-2008; USA 1999-). Spanish ***representative*** in the "IUPAC Solid State and High Temperature Chemistry Committee. (1987-1992). ***Member*** of the Academic Council of the Real Colegio Complutense in Harvard University (1990-2016). ***Professor*** of courses on *Atmospheric Chemistry and Climate Change* in Summer Courses at the Royal College of the UCM at Harvard University (1995-1999). ***Member*** of the Scientific Committee of the Institute of Materials of the Polytechnic University of Grenoble INPG (1996-9). Scientific ***Auditor*** of the Institute of Materials UNAM – Mexico (1997-2006). ***Member*** of the Steering Committee of the Chimie du Solide Laboratory CNRS Amiens, France (1993-5). ***Member*** of the advisory board of the Castilla-La Mancha Museum of Science (1997-2003). ***Member*** of the Scientific Committee "European High Pressure Research Group" (1998-

1990). ***Member*** of the Consultative Council on Research and Development of the Presidency of the Valencian Community (1999-). ***Member*** of the International Committee (1988-2008) and ***plenary lecturer***: HTSC-M^2S Congresses: Interlaken1988, Grenoble 1994, Beijing (***Chairman*** of session) (1997), Houston 2000. Stuttgart (2006). ***Promoter and member*** of the Scientific Committee of the First Spanish-French Meeting on Inorganic Materials (1986).

2.-Publishing Activity: Books & Journals

2-1.- Author

Co-author (with J.L. Vicent) of the first book on Superconductivity in the Spanish Language (Ediciones EUDEMA 1991). ***Author*** of the Monographs: "On Superconductors and Other Materials" (1993); "Superconductivity: Pressure, temperature and other paths" (2001) Edition: Royal Academy of Sciences of Spain. ***Publisher*** and author of the book: "The Science of the Solid State". UIMP. Edition Royal Academy of Sciences of Spain (1984). ***Co-editor,*** with J.A. Gonzalo and J.L. Sánchez Gómez of the monograph*: Astrophysical Cosmology*. Alianza Editorial 1995. ***Editor*** of the "Summary of the Research Lines and Services of UCM": **Four volumes -** 400 pages: Humanities, Social Sciences, Health Sciences and Experimental Sciences (1996).

Co-editor of five books of Meetings proceedings: Reactivity of Solids Madrid 1992: Elsevier 1993. (Three volumes). Solid State Chemistry of Inorganic Materials Boston 2002, Editorial MRS 2003.

Editor and author ***"Proceedings of the International Symposium: Superconductivity & Pressure: a fruitful relation"***. Areces Foundation, MADRID, November,2019.
https://www.fundacionareces.es/fundacionareces/es/publicaciones/listado-de-publicaciones/proceedings-of-the-international-symposium-superconductivity-and-pressure-a-fruitful-relationship-on-the-road-to-room-temperature-superconductivity.html?tipo=2

2-2.-Translator

Science (*to Spanish*): **A Modern Approach to Inorganic Chemistry:* C.F. Bell & K.A.K. Lot (1967) ***L'Evolution des Idées en Physique:* A. Einstein & L. Infeld (1968).

Poetry (Spanish to English. Bilingual edition) *Las Heridas del Tiempo:* (*The wounds of time)*. Mercedes Alario G.-V. Editions G and A (2016). *The friends I loved.* Mercedes Alario G.-V. (Spanish to French and to English: trilingual Edition). (In preparation).

2-3.-Associate Editor of International Scientific Journals

Microscopy, Microstructure and Analysis; Bulletin of Materials Science & Materials Research Bulletin.

2-4.-Member of the Scientific Committees of International Journals

Journal of Solid-State Chemistry (1978-), Journal of Materials Chemistry, European Journal of Inorganic Chemistry, Solid State Sciences & Annals of Chemistry (1974--2014).

2-5.-Referee for numerous international journals & magazines

Subjects: Solid State Physics; Solid State Chemistry, Materials Science, Inorganic Chemistry, Crystallography, Diffraction, Magnetism, Superconductivity, High Pressure…etc, etc.

For papers & articles in Scientific Journals: See below –sections 11 & 12

3.- Mentoring

Concerning Professor Alario-Franco high ***mentoring*** "capacity", one has to mention that, ***more than 70 undergraduate students did a Master Thesis*** under his guidance and, even more importantly, ***more than 25 graduate students did make their PhD*** work under his supervision in his research group. The great majority of these Doctoral students went, immediately after their Ph.D. Exam, to foremost foreign research centres, and then came back to the Spanish group, that become the most important one in the country, and among the best in Europe.

Of these past students, there are today 14 University Professors which all have their independent research lines, either in UCM (7 professors) or outside it (the rest). Also, 2 Research Professor/CSIC; 1 Director of Research/CNRS and Associated Professors and Scientific Researchers most of the rest.

3-1.- Doctoral thesis supervised. ***(One third in co-direction)***
Disciples: 27

Mª José Torralvo Fernández (Profesor titular UCM)
José María Gonzalez Calbet. Catedrático UCM
Luis Carlos Otero Díaz. Catedrático UCM
Pilar Herrero Fernández:(Científico titular: CSIC ,ICMM)
Emilio Morán Miguélez. Catedrático. UCM
Mª Jesus Rodríguez Henche (Industria)
Antonio Jerez Méndez. Catedrático UNED
Flaviano García Alvarado Catedrático CEU
Ulises Amador Elizondo Catedrático CEU
Carmen Rial (Industria-REPSOL)
Aloys Kuhn. Catedrático CEU
Mª Antonia Señarís Rodríguez. Catedrática. U de La Coruña
Alejandro Várez Álvarez. Catedrático Universidad Carlos III, Madrid
Azael Martínez de la Cruz (Prof Titular U.A. Nuevo León, –México)

Marisol Martín González (Profesora de Investigación CSIC-Madrid)
Myriam Aguirre (Investigadora Científica CSIC ICM Aragón, Zaragoza))
Ainhoa Morata Orrantia (Consultora Científica ANEP)
Rocío Ruiz Bustos (Profesor titular U Córdoba)
Antonio Juan Dos Santos (Profesor Titular UPM)
Elizabeth Castillo Martínez (Profesor Ayudante Doctor (UCM)
Ángel Arevalo López (Chargé de recherche CNRS Lille)
Sourav Marik (Chercheur ICMAB- Burdeos)
Iván Pirrotta (Industria, Italia)
Javier Fernández San Julián (Técnico superior UCM)
Irene Herrero Ansorregui (profesora Enseñanza Media)
Xabier Martínez de Irujo Labalde (Postdoc Universidad de Oxford)
Sara López Paz (Post Doc Dept of Physics, Univrsity of Geneva)

3-2.-Other students:6

María Vallet Regí Catedrática (Director de su Tesina, codirector de Tesis y colaboradora durante más de 15 años)
Susana García Martín Catedrática Universidad.(Colaboradora durante mas de 20 años)
María Luisa Veiga Blanco. Catedrática (Director de Tesina)
Marina Parras Vázquez. Catedrática (Director de Tesina)
Catherine Chaillout: Grenoble. Directeur de Recherche (Directeur These 3eme Cycle) CNRS. Cristalographie, Grenoble.
Mauricio Barahona (Director de tesina)- Catedrático de Biomatemática- Imperial College-Londres

4.- Member of thesis juries abroad 17

Member of the jury of more than ~75 Doctoral Theses ***in Spain***.
Member of the jury of 17 Doctoral Theses and Habilitations ***abroad***
President of three other Juries: in France – University of Bordeaux- in Russia – Lomonosov University-and in Colombia –Universidad del Valle.

- J. Muller, Universidad de Grenoble (1977)
- M. Pernet, Universidad de Grenoble (1978)
- M. Labeau, INPG, Grenoble (1980)
- C. Laviron, INPG, Grenoble (1981)
- J.-L- Hodeau, Universidad de Grenoble (1984)
- V. Caignaert, Universidad de Caen (1986)
- M. Parras, Universidad de Burdeos (1989)
- N. Lagueyte, Universidad de Burdeos (1990)
- E. Gautier, Universidad de Grenoble (1997)
- S. Malo, Universidad de Caen (1998)

- A. Paulus, Universidad de Paris Sud (Orsay) (1998)
- S. Kazakov, Universidad de Moscú (1998) **(presidente** del Tribunal)
- Justin Jeanneau, Institute Neél, CNRS. Grenoble 2016 (**Presidente del Tribual**)
- Foreing Jury in 2 thesis :Indian Institute of Science, Bangalore India (2001 y 2004)
- Foreing Jury in 1 thesis: Indian Institute of Technologies, Madras India (2009)
- Member of the Jury (virtual)one tesis. Universidad del Valle. Colombia

5.- Foreign visitors who have worked in collaboration with or under his direction in the Solid-State Chemistry Laboratory in UCM: 35

- J. L. Hodeau. CNRS, Grenoble, FRANCIA (3 meses. 1978).
- M. Labeau. INPG, Grenoble, FRANCIA (2 meses. 1983).
- J. C. Grenier. CNRS, Burdeos, FRANCIA (2+2 meses. 1984, 1986).
- Nathalie Lagueyte. CNRS, Burdeos, FRANCIA (3 meses. 1989)
- Andreas Kaul. Universidad Lomonosv, Moscú, Rusia (1 mes, 1990).
- Ann Chippindale. Universidad de Oxford, (2 meses. 1990).
- P. Melnikov. Universidad Lomonosov. Moscú, Federación Rusa (1 mes, 1990 un año en 1991-1992).
- J. Torrance. IBM. San José, California, EE. UU (1 año en 1992-1993)
- S. R. Melton. Universidad de Pensilvania, EE. UU (3 meses, 1993).
- C. Hetherington. Universidad de Berkeley, California, EE. UU (2 meses, 1990 y 2 años, 1991-1992).
- Ph. Saint-Mard, Universidad de Lieja, BÉLGICA (4 meses. 1989-1990, un año en 1991).
- Elke Pahl. Universidad de Heidelberg, ALEMANIA (10 meses. 1990-1991).
- Jean-Pierre Levi. Laboratoire de Cristallographie- CNRS Grenoble (2 semanas) 1986
- Maurice Perroux. Laboratoire de Cristallographie- CNRS Grenoble (2 semanas) 1987
- Roger Argoud Laboratoire de Cristallographie- CNRS Grenoble (2 x 2 semanas)1988
- Aloys Kuhn. Universidad de Tubinga, ALEMANIA (3 años, 1993-1995).
    - *Tesis Doctoral "cum Laude"*
- Christian Steudner. Universidad de Tubinga, ALEMANIA (2 años)1994-1995).
- Mark Wiesmann, Technische Hochschule, Darmstadt, ALEMANIA
- (1 mes)1995
- Helmuth Ehrenberg, Technische Hochschule, Darmstadt, ALEMANIA
- (1 mes, 1 semana) 1996.
- Helmuth Fuess; Technische Hochschule,

- Darmstadt ALEMANIA (una semana) 1996
- Joachim Alkemper, Technische Hochschule, Darmstadt, (1 mes. 1996).
- Guenan Goriot. Ecole de Hautes Études Europeennes de Chimie, Strasburg, Francia (4 meses. 1995).
- Angélica M. Stacy, Universidad de California (Berkeley), California, EE. UU. (3 meses. 1997).
- Bruce Hyde: Australian National University, Caberra (seis meses) 1994.
- Andreas Kaul, Universidad Lomonosov, Moscú, Rusia; (tres meses) 1995.
- Evgeny Antipov Universidad Lomonosov, Moscú, Rusia; una semana 1996.
- Myriam Aguirre. Universidad José San Martín-Citefa, Buenos Aires, ARGENTINA: (1998-2004) cuatro años. - **Tesis doctoral. Cum laude"**
- Nikolay Nikolayev High Pressure Institute, Tronsk,
- Rusia (tres meses II-08 a V-2008)
- Joost van Dujin, ISIS, Oxford (UK) Contratado Ramon y Cajal
- (dos años) 2006-2008
  Kenneth Poeppelmeyer. Northwestern University, Evanston Illinois (USA)
- tres Meses: Abril-Julio 2009
- Theodora Stajanova Louberova, Universidaad de Sofía (dos años) 208-2010
- Sourav Marik. Becario Marie Curie -Proyecto Soprano- cuatro años
- **Tesis doctoral "cum laude"**
- Iván Pirrotta Becario Marie Curie -Proyecto Soprano- cuatro años
- **Tesis doctoral "cum laude"**
-

Tutor of two 1-year USA Fulbright Fellowships (1 in 2003 from Cornell University -From **Prof. Frank di Salvo**- and 1 in 2015 from Princeton University -from **Professor Robert J. Cava**).

6.-Other foreign scientists who have visited the Solid State Chemistry Research Group and lectured: 23.

6-1.-Nóbel Prize Awardees:5

Roald Hoffman- Cornell University (*P. Nobel* de Química- 1981) – 1997.

Mario Molina, MIT- Cambridge (*P. N*obel de Química 1995) -2012.

Sir Harold Kroto, University of Florida, (*P Nobel de Química*- 1996)1995, 2000,2012.

John B. Goodenough. -U.of Texas Austin (*P Nobel de Química*- 2019)-1999 y 2002.

Stan Whittingham. Binghamton University, New York (1992, 2022)

6-2.-Other distinguished Scientists: 18

Manuel Cardona, MPI, Stuttgart, many times in 1988-2010

LeRoy Eyring, Arizona State University (una semana) 1984

Peter Bruce. Department of Materials. Oxford University (una semana) 2002

Jean Claude Joubert INPG-Grenoble (varias semanas)1978-2009.

Michel Armand, Universié de Montreal, (dos semanas) 2002 y 2014

Roger Argoud- Laboratoire de Cristallographie- CNRS Grenoble. (dos semanas)1996

Jean Etourneau. Institute de Science de Materiaux de Bordeaux (dos semanas)

Claude Delmas. Institute de Science de Materiaux de Bordeaux (una semana) 2002

Anthony R. West (University of Sheffield) 2011

Truls Norby, University of Oslo (una semana) 2002

Bernard Raveau,Université de Caen (una semana)

María Ondina Figueiredo, Universidade de Lisboa (una semana) 1993

J. Gopalakhrisnan. Indian Institute of Science, Bangalore. una semana (2002)

Gerbrand Ceder, MIT (una semana) 2002.

Sir John Meurig Thomas. Tres veces (1992; 1996, 2002)

CNR Rao. Indian Institute of Science, Bangalore (tres visitas) (1992, 2002, 2012)

Ivan K. Schuller, UCSD, California. Más de seis veces 1988 a 2016

Hideo Osono MSL TITECH-Japón. dos veces 2011 y 2018

Hiroshi Kageyama, Kyoto University 2019.

6-3. The "Mexican Contingent": 16

The scientific relationship with Mexico has been very intense, particularly after the award to Prof. Alario-Franco of the *America Chair* by the Royal Institute of Spain to teach at the Universidad Autonoma de Mexico for 2 months in 1996. For this reason, a substantial group of Mexican scientists,16, have worked with him in the Solid-State Chemistry research group of UCM:

- **J. Saniger Blesa,** UNAM, MÉXICO (1 mes en 1991, 6 meses en 1996).
- **Jorge Ibarra Rodríguez**, Universidad Autónoma de Nuevo León, Monterrey, MÉXICO, (3 meses. 1994).
- **Leticia M. Torres**, Universidad Autónoma de Nuevo León, Monterrey, MÉXICO (1 semana. 1993-1997).
- **Azael Martínez de la Cruz**. Universidad Autónoma de Nuevo León, Monterrey, MÉXICO (24 meses. 1994-1995-1996-1997).
- **Tesis Doctoral** "cum Laude"
- **Ángel Arévalo** (Departamento de Física UNAM, México D.F.:

- Tesis Doctoral “cum Laude” con Premio Extraordinario (actualmente *Chercheur* en el CNRS, Lille, Francia)
- **José Luis Rodríguez Mazariego** (UNAM, Méjico, DF): un mes, octubre 2007 y otro en 2009).
- **Raúl Escamilla** (UNAM, MÉXICO 12 meses en 2001-2002; 3 meses en 2003; 1 mes en 2004)
- **Inés Rosales** (UNAM, MÉXICO) 3 meses en 2002
- **Román Caudillo** (Universidad de Texas, Austin) 3 meses 2005
- **Alejandro Durán** UNAM, Centro de Materia Condensada, Ensenada, Baja California, MÉXICO, 1 mes en 2004, 3 meses en 2007 y 3 meses en 2008
- **José Chaves Carvayar**, Instituto de Ciencia de Materiales de la Universidad Nacional Autónoma de Méjico: Un año (IX-2006-VIII-2007).
- **María Elena Villafuerte**, Instituto de Ciencia de Materiales de la Universidad Nacional Autónoma de Méjico: Un año (IX-2007-VIII-2008) y numerosas estancias de uno a tres meses.
- **Luis Fuentes Cobas**: Instituto de Materiales de Chihuahua, Méjico, tres meses (III-08-a V-08). Y varias estancias breves.
- **María Elena Montero,** Facultad de Física Universidad de Chihuahua. Un mes (V-08) y varias estancias breves
- **Marco Guaderrama,** Investigador posdoctoral UNAM,
- un año: I-08-XII-08.
- **Rocío Simón:** Instituto Politécnico Nacional de México
- (1-1-2014 a 2-6-2014)

6-4.-Other Mexican Scientists who have visited the laboratory of Solid State Chemistry and lectured there: 5

- **Raúl Valenzuela**. **Instituto de Investigación en Materiales-UNAM-Mx**
- **Raúl Gómez. Facultad de Física UNAM**
- **Vivian Marquina. Facultad de Física UNAM**
- **Roberto Escudero. Instituto de Investigación en Materiales-UNAM**
- **Jesús Heiras. Instituto de Investigación en Materiales-UNAM- Ensenada**

7.-Scientists who have worked on the Complutense High Pressure Laboratory: 17

- **Jim Haines,** Université de Montpellier/CNRS: High Pressure Laboratoire.
- **Colin Greaves,** Birmingham University.
- **Paul J. Attfield.** Materials at extreme conditions. University of Edinburgh.
- **Regino Sáez Puche**, UCM.
- **José Mª González Calbet**, UCM.
- **Ángel Vegas Molina.** Instituto Rocasolano CSIC.
- **Román Caudillo & John B. Goodenough .** University of Texas, Austin

- **Ulises Amador y Flaviano García Alvarado**. Universidad San Pablo/CEU.
- **María Antonia Señarís.** Universidad de La Coruña.
- **Harmut Fuess.** Darmstadt Universitet
- **Helmuth Ehrengerg**: Dresden Universitet
- **Iván Schuller.** UCSD, USA
- **Ken Poeppelmeier (Univ de Chicago)**
- **Jordi Cabanas & Gene Nolis (**University of Ilinois-Chicago)
- **Teófilo Rojo**: Universidad del País Vasco
-

8.-Total number of Scientists that have visited, interacted and work in different ways, in the S-S Chemistry group along the ~48 years.

Master thesis students 70, PhD disciples 27, other students 6, foreign visitors 35, other foreign scientists visiting and lecturing: Nobel P. 5; other foreigner19; Mexican C 16; Mexican V 5 & High P Lab working 17**.**

In TOTAL: ~ (70 +130) scientists have benefited of the Solid-State Chemistry group that I founded & directed from 1974 in Universidad Complutense: ~200

9.-Some of the Invited Conferences and Talks

Guest speaker at numerous international institutions, congresses, universities and research centres in ***more than 30 countries***: ***Europe***: In Spain in all the 17 autonomous communities and, within them, in all the provinces *(there are 50)* except Zamora, Ávila, Lérida and Orense. *Portugal, France, Italy, Greece, Turkey, Belgium, Holland, Germany, Austria, Czechia, Denmark, Sweden, Norway, Finland, United Kingdom (England, Scotland, Wales), Poland, Hungary, Russia.* ***Asia:*** *Japan, Korea, India, Hong-Kong, China, Thailand*. ***America***: *Canada, USA, México, Cuba, Argentina*. ***Oceania***: *New Zealand*. Estimated Number of those talks ~250.

Among them: ***Speaker and co-chairman*** at the opening session and 7 communications at the 1st European Congress on High Tc Superconducting Materials, Genoa (ITALY), 1987. ***Invited plenary conference***: MRS Spring Meeting: HTSC Materials, San Diego, USA (1989) (Only three European plenary lecturers). ***Member of the HTSC-M^{2}S committee***: Interlaken (Switzerland) 1988, Grenoble (1994), ***President of the session*** in Beijing; (1997), Houston 2000. Invited ***Speaker*** at *Reuniao Hispanoportuguesa de Adsorçao*. Lisbon (Portugal), 1980. Invited ***Speaker*** at the European Symposium on Thermal

Analysis. Aberdeen (Great Britain), 1981.Invited ***Speaker*** at the Gas-Solid Interface Symposium. C.N.R.S. Aix-en-Provence (France), 1981: ***Speaker*** at the 2nd European Conference on Solid State Chemistry, Eindhoven (Holand), 1982. Invited ***Speaker*** at the Euchem Conference on H.R. Electron Microscopy. Stockholm (Sweden), 1983. *Speaker* at the EMAG Conference, Newcastle (Great Britain), 1985. Invited *Speaker* at the III European Conference on Solid State Chemistry, Regensburg, (Germany)1986.

Invited plenary speaker at the *Gordon Research Conferences in Solid State Chemistry* held in Plymouth (NH-USA) ***in 1990 and, 22 years later, in 2012,*** in London (NH-USA). ***Invited plenary speaker*** at the Gordon Research Conference in Superconductivity, Ventura California 1991.
Session Chair in another half a dozen Gordon R. Conferences in SSCh in New London NH USA (2000-2015)

Chair of the Gordon Research conference on Solid State Chemistry Oxford (2003)

Co-Chair and Speaker: Symposium on Solid State Chemistry of Inorganic Materials at the Fall Meeting ***MRS,*** Boston 2002. ***Chair and Speaker*** of the Joint Session of the Symposia: Solid State Chemistry of Inorganic Materials and Solid-State Ionics at the Fall Meeting of the Materials Research Society of America (Boston Massachusetts, 2008). ***Co-Chairman and Speaker*** of the Symposia on Non-Molecular Solids at the International Materials Research Congress (USA-MRS + Mexican-MRS: Cancun, Mexico (2006-10 and 2012, 2014-2018).
Speaker and Session Chair at the Symposium "New trends in SS Chemistry: from oxide to mixed anion compounds, Toyota Museum of Technology, Kyoto. Japan (November 2017) + ***Plenary lecture at the gala dinner***. ***Speaker and session*** chair at the Symposium: Solid State Chemistry of Functional materials: Ningbo. China (2018).
Director and plenary lecture at the Symposium of the Areces Foundation "Materials for batteries & Fuel Cells. Madrid 2002.
Director of the series of 16 Lectures *"Scientists from Galicia"* in Galicia House, Madrid. (2007-8).
Director and plenary lecture. International Symposium of the Areces Foundation: High Temperature Superconductivity and Related Materials: Twenty years after. Madrid 2007
Director and plenary lecture: Symposium of the Areces Foundation: in the International Year of Chemistry IUPAC/ UNESCO: "The Chemistry of Our Time" Madrid 2011.
Director and Plenary Lecture: Areces Foundation Symposium "Superconductivity and Pressure: A fruitful relation on the road to Room Temperature Superconductivity". ***Guest Speaker*** in the **Graduation** C**eremony** of various Universities: UCM-1989 and San Pablo / CEU (1981) and in the Faculty of Chemical Sciences of UCM in 2016.
Postgraduate Professor at the Institute of Advanced Materials and School of Chemistry and Chemical Engineering. New Orleans***, Fall of 2018.***
Doctoral Professor *at Southeast University. Nanjing (China): Virtual (due to COVID restrictions) lec*tures on superconductivity ***Fall of 2021***.

10.-International Symposia organized in the UCM Research Group on S-S. Chemistry

***Symposium for the Inauguration of the High-Pressure Laboratory, 1986**
****-International Symposium on the Reactivity of Solids, 1992.***
Materials for Energy: Batteries and Fuel Cells *(F. Areces), 2002
***100 years of High Temperature SC and related materials: UIMP, 2011**
***The Chemistry of Our Time/International Year of Chemistry (F. Areces), 2011**
***Superconductivity and Pressure: A Fruitful Relationship (F. Areces), 2019**

11.-Publications: Author/ co-author of more than 360 research articles

Some much-cited Publications

TITLE	CITED BY	YEAR
X-ray photoelectron spectroscopic studies of CrO2 and some related chromium compounds		
I Ikemoto, K Ishii, S Kinoshita, H Kuroda, MAA Franco, JM Thomas		
Journal of Solid State Chemistry 17 (4), 425-430	276	1976
Hexagonal versus perovskite phase of manganite		
JS Zhou, JB Goodenough, JM Gallardo-Amores, E Morán, ...		
Physical Review B 74 (1), 014422	212	2006
The ASnO3 (A= Ca, Sr) perovskites		
A Vegas, M Vallet-Regi, JM González-Calbet, MA Alario-Franco		
Acta Crystallographica Section B: Structural Science 42 (2), 167-172	189	1986
Oxygen vacancy ordering in $Ba_2YCu_3O_{7-x}$ around x= 0.5		
C Chaillout, MA Alario-Franco, JJ Capponi, J Chenavas, P Strobel, ...		
Solid state communications 65 (4), 283-286,	160	1988.
Crystallization behavior of zirconium oxide gels		
MJ Torralvo, MA Alario, J Soria		
Journal of Catalysis 86 (2), 473-476,	150,	1984.
A family of non-stoichiometric phases based on $Ba_2YCu_3O_{7-\delta}$: δ ($0 \leq \delta \leq 1$)		
MA Alario-Franco, C Chaillout, JJ Capponi, J Chenavas, M Marezio		
Physica C: Superconductivity 156 (3), 455-460	139	1988
Oxygen-vacancy ordering in the $Ba_2YCu_3O_{7-x}$ ($0 \leq x \leq 1$) superconducting system.		
C Chaillout, MA Alario-Franco, JJ Capponi, J Chenavas, JL Hodeau, ...		
Physical Review B 36 (13), 7118	119	1987
Microstructural study of $La_{0.5}Li_{0.5}TiO_3$		
A Várez, F Garcıa-Alvarado, E Morán, MA Alario-Franco		
Journal of Solid-State Chemistry 118 (1), 78-83,	107,	1995.
Crystal Structure and Microstructure of Some $La_{2/3-x}Li_{3x}TiO_3$ Oxides: An Example of the Complementary Use of Electron Diffraction and Microscopy …		
S García-Martín, MA Alario-Franco, H Ehrenberg, J Rodríguez-Carvajal, ...		
Journal of the American Chemical Society 126 (11), 3587-3596,	103,	2004.
Brownmillerite-type microdomains in the calcium lanthanum ferrites: $Ca_xLa_{1-x}FeO_{3-y}$: I. 3< x< 1		
MA Alario-Franco, JM Gonzalez-Calbet, M Vallet-Regi, JC Grenier		
Journal of Solid-State Chemistry 49 (2), 219-231	101	1983

A new HTSC family: the copper analogs of the single-layer Hg or Tl copper oxide superconductors
MA Alario-Franco, C Chaillout, JJ Capponi, JL Tholence, B Souletie
Physica C: Superconductivity 222 (1-2), 52-56 97 1994

Lithium-ion conductivity in the novel $La_{1/3-x}Li_{3x}NbO_3$ solid solution with perovskite-related structure
S Garcıa-Martın, JM Rojo, H Tsukamoto, E Morán, MA Alario-Franco
Solid State Ionics 116 (1-2), 11-18, 95, 1999.

Magneto-thermal and dielectric properties of biferroic $YCrO_3$ prepared by combustion synthesis
A Durán, AM Arévalo-López, E Castillo-Martínez, M García-Guaderrama, ...
Journal of Solid-State Chemistry 183 (8), 1863-1871, 93, 2010.

Report from the third workshop on future directions of solid-state chemistry: The status of solid-state chemistry and its impact in the physical sciences
MG Kanatzidis, KR Poeppelmeier, S Bobev, AM Guloy, SJ Hwu, ...
Progress in Solid State Chemistry 36 (1-2), 1-133, 84, 2008.

Phonons in $Nd_{2-x}Ce_xCuO_4$
ET Heyen, G Kliche, W Kress, W König, M Cardona, E Rampf, J Prade, ...
Solid state communications 74 (12), 1299-1304, 82, 1990.

Electrochemical topotactic oxidation of nonstoichiometric perovskites at ambient temperature
A Nemudry, EL Goldberg, M Aguirre, MÁ Alario-Franco
Solid state sciences 4 (5), 677-690, 81, 2002.

Oxygen vacancy ordering and non-stoichiometry in the $Ba_2YCu_3O_{7-x}$ superconductors
MA Alario-Franco, C Chaillout, JJ Capponi, J Chenavas
Materials research bulletin 22 (12), 1685-1693 79 1987

Microdomain texture and oxygen excess in the calcium-lanthanum ferrite: $Ca_2LaFe_3O_8$
MA Alario-Franco, MJR Henche, M Vallet, JMG Calbet, JC Grenier, ...
Journal of Solid-State Chemistry 46 (1), 23-40, 77, 1983.

Phonon anomalies and structural stability in the R 2− x Ce x CuO 4 system (R= Gd, Sm, Nd, Pr)
ET Heyen, R Liu, M Cardona, S Piol, RJ Melville, DMK Paul, E Morán, ...
Physical Review B 43 (4), 2857 60 1991

On the structure and microstructure of "PbCrO3"
ÁM Arévalo-López, MÁ Alario-Franco
Journal of Solid-State Chemistry 180 (11), 3271-3279 58 2007

Electrical resistivity of the Ti-O Magneli phase under high pressure
C Acha, M Monteverde, M Nunez-Regueiro, A Kuhn, A Franco
The European Phys. J. B-Condensed Matter and Complex Systems 34 (4 … 58 2003

A new series of magnetic rare earth cuprates: RCu_2O_4 (R= La, Nd, Sm, and Eu)
SW Keller, VA Carlson, D Sandford, F Stenzel, AM Stacy, GH Kwei, ...
Journal of the American Chemical Society 116 (18), 8070-8076 58 1994

Optimization of lithium conductivity in La/Li titanates
A Morata-Orrantia, S García-Martín, MA Alario-Franco
Chemistry of materials 15 (21), 3991-3995 54 2003

A New La2/3Li x Ti1-x Al x O3 Solid Solution: Structure, Microstructure, and Li+ Conductivity
A Morata-Orrantia, S García-Martín, E Morán, MÁ Alario-Franco
Chemistry of materials 14 (7), 2871-2875 53 2002

In situ reduction of (100) SrTiO3
MSM González, MH Aguirre, E Morán, MÁ Alario-Franco, V Perez-Dieste, ...
Solid State Sciences 2 (5), 519-524 53 2000

Sur le système $BaFeO_{3-y}$ ($0< y\leq 0.50$)
JC Grenier, A Wattiaux, M Pouchard, P Hagenmuller, M Parras, M Vallet, ...
Journal of Solid-State Chemistry 80 (1), 6-11 52 1989

XRD study of ZrW_2O_8versus temperature and pressure

JM Gallardo-Amores, U Amador, E Moran, MÁ Alario-Franco
International journal of inorganic materials 2 (1), 123-129 48 2000

Structural studies on A-cation-deficient perovskite-related phases. I. ThNb4O12, thorium/vacancy ordering in slow-cooled samples
MA Alario-Franco, IE Grey, JC Joubert, H Vincent, M Labeau
Acta Crystallographica Section A: Crystal Physics, Diffraction, Theoretical … 47 1982

The superconducting "copper/carbonate cuprates" An electron microscopy study
MA Alario-Franco, P Bordet, JJ Capponi, C Chaillout, J Chenavas, ...
Physica C: Superconductivity 231 (1-2), 103-108 46 1994

The porous structure of synthetic akaganeite
JM González-Calbet, MA Alario-Franco, M Gayoso-Andrade
Journal of inorganic and nuclear chemistry 43 (2), 257-264 46 1981

Modulated structure of $La_{1/3-x}Li_{3x}NbO_3$ $0 \leq x \leq 0.06$ perovskite-related materials
S García-Martín, MA Alario-Franco
Journal of Solid-State Chemistry 148 (1), 93-99 43 1999

Anion deficiency in iron perovskites: The $Sr_xNdv_{1-x}FeO_{3-y}$ solid solution I: 0, 6< x< 0, 8
MA Alario-Franco, JC Joubert, JP Lévy
Materials Research Bulletin 17 (6), 733-740 43 1982

High-Pressure Synthesis and Local Structure of Corundum-Type $In_{2-2x}Zn_xSn_xO_3$ ($x \leq 0.7$)
CA Hoel, JMG Amores, E Morán, MA Alario-Franco, JF Gaillard, ...
Journal of the American Chemical Society 132 (46), 16479-16487 40 2010

Structural and superconducting properties of $La_{2-x}Sr_xCuO_{4+y}$ (0< x< 0.15) prepared by room temperature chemical oxidation
C Rial, E Morán, MA Alario-Franco, U Amador, NH Andersen
Physica C: Superconductivity 254 (3-4), 233-248 39 1995

Reliable method for determining the oxidation state in chromium oxides
AM Arévalo-López, MA Alario-Franco
Inorganic chemistry 48 (24), 11843-11846 38 2009

Total Citations: 5.174. H-INDEX: 37; I10 INDEX: 115

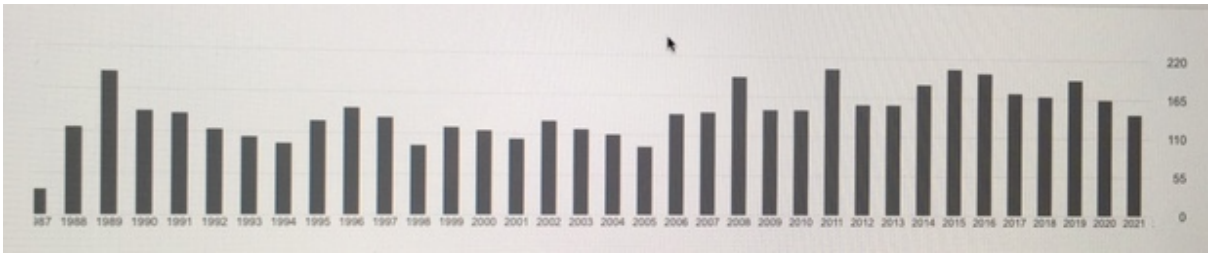


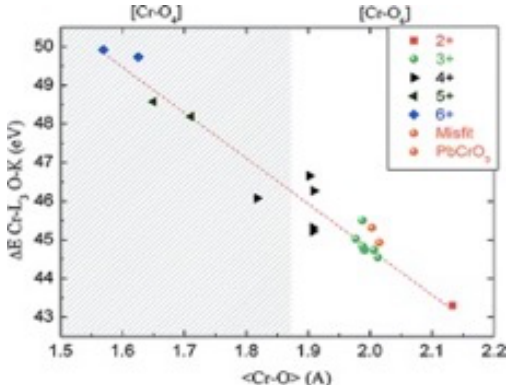
Figure 1.-AVERAGE YEARLY CITATIONS, LAST 30 YEARS: ≃155

Google Scholar

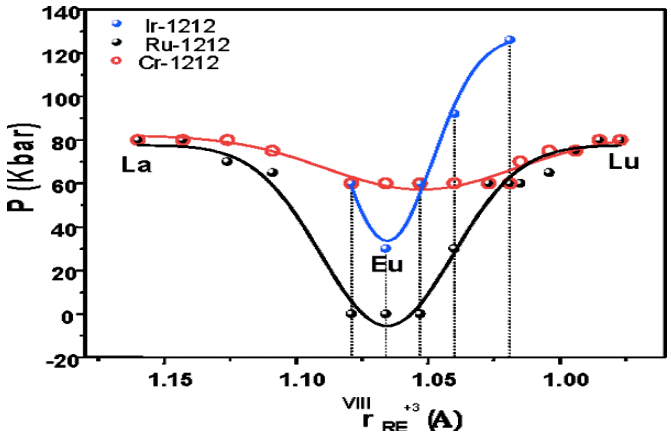
Attendance to Scientific Congresses: > 200

12.-Some of the more interesting publications with specific comments: A personal view

Reliable Method for Determining the Oxidation State in Chromium Oxides
Ángel M. Arévalo-López and Miguel Á. Alario-Franco
Inorg. Chem., **2009**, *48* (24), pp 11843–11846
Publication Date (Web): November 24, 2009 (Article)
DOI: 10.1021/ic901887y
We show that an appropriate analysis of the electron energy loss spectra in relation to the Cr−O bonds gives a reliable methodology to obtain the oxidation state in chromium oxides. It is based on the energy difference between the Cr L_3 and O K edges, ...



Ahead of the Lanthanide Contraction; Pressure and Ionic Size in the Synthesis of $MSr_2RECu_2O_8$ (RE = Rare Earth, M = Ru, Cr, Ir): a Gaussian Relation
M. Á. *Alario-Franco*, R. Ruiz-Bustos *and* A. J. Dos Santos-García
Inorg. Chem., **2008**, *47* (14), pp 6475–6481
Publication Date (Web): June 14, 2008 (Article)
DOI: 10.1021/ic7020676
We have been working for some time on the synthesis at high pressure ($P \leq 12.5$ Gpa) and high temperature ($T \leq 1400$ K) of new materials of the type $MSr_2RECu_2O_8$(RE = Rare Earth), which formally derive from YBCO (i.e., $CuBa_2YCu_2O_7$) by replacing the [Cu−O_4] ...



New Materials Derived from Ybco: $CrSr_2RECu_2O_8$ (RE = La, Pr, Nd, Eu, Gd, Tb, Dy, Y, Ho, Er, Lu)

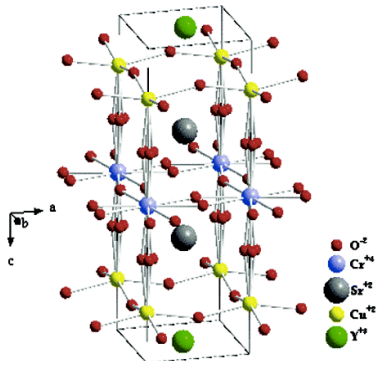
Rocío Ruiz-Bustos, Myriam H. Aguirre, and Miguel Á. Alario-Franco

Inorg. Chem., **2005**, *44* (9), pp 3063–3069

Publication Date (Web): March 29, 2005 (Article)

DOI: 10.1021/ic048929y

Eleven new oxides, derived from yttrium barium copper oxide by replacing the square-planar copper [$Cu-O_4$] of the basal plane of the triple perovskite-based structure with octahedral Cr^{IV}, have been prepared at high pressure and temperature. Their crystal ...



Increasing the Structural Complexity of Chromium(IV) Oxides by High-Pressure and High-Temperature Reactions of CrO_2

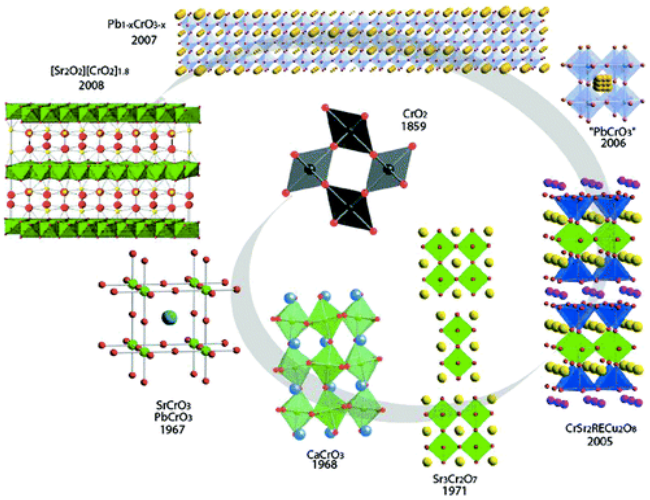
E. Castillo-Martínez, A. M. Arévalo-López, R. Ruiz-Bustos and M. A. Alario-Franco

Inorg. Chem., **2008**, *47* (19), pp 8526–8542

Publication Date (Web): September 29, 2008 (Article)

DOI: 10.1021/ic801015b

This work presents an overview of a series of increasingly complex oxides synthesized from CrO_2, under high-pressure and high-temperature conditions, having Cr^{4+} in octahedral coordination. Although the emphasis is on the structure and microstructure of …



Influence of Structural (Cation and Anion) Order in the Superconducting Properties of Ozone-Oxidized $Mo_{0.3}Cu_{0.7}Sr_2RECu_2O_y$ (RE = Yb, Tm, Gd, Nd, and Pr)

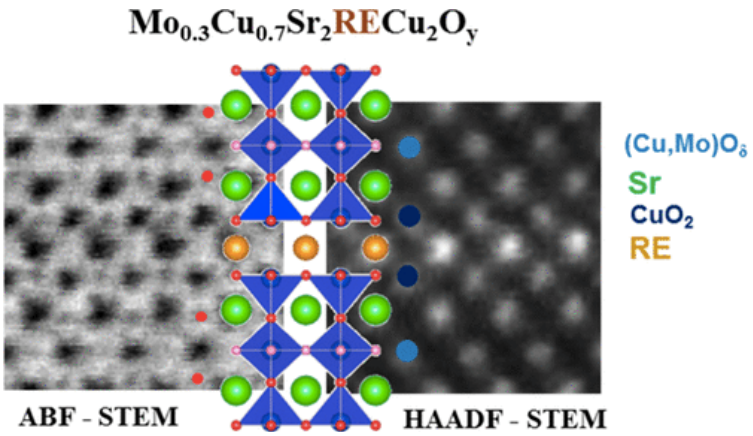
Xabier Martínez de Irujo-Labalde, Esteban Urones-Garrote, Susana García-Martín, and Miguel Ángel Alario-Franco

Inorg. Chem., **2018**, *57* (19), pp 12038–12049

Publication Date (Web): September 19, 2018 (Article)

DOI: 10.1021/acs.inorgchem.8b01594

The influence of rare earth (RE) elements on superconducting properties of the transition element (TE)-substituted $TE_xCu_{1-x}Sr_2RECu_2O_y$ cuprates has not been sufficiently emphasized so far. In the case of molibdo-cuprates with the general formula $Mo_{0.3}Cu_{0.3}$...



Spinel to $CaFe_2O_4$ Transformation: Mechanism and Properties of β-$CdCr_2O_4$

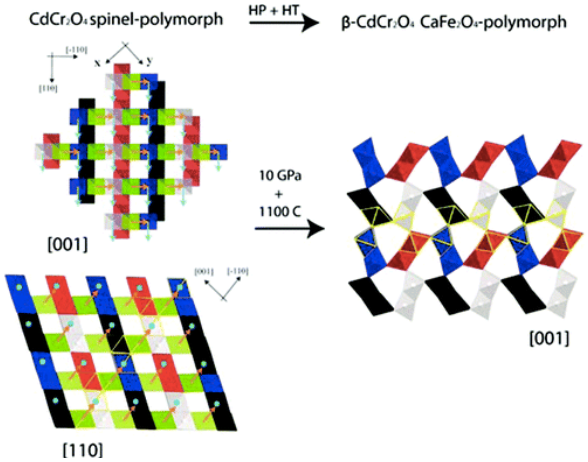
Ángel M. Arévalo-López, Antonio J. Dos santos-García, Elizabeth Castillo-Martínez, Alejandro Durán and Miguel Á. Alario-Franco

Inorg. Chem., **2010**, *49* (6), pp 2827–2833

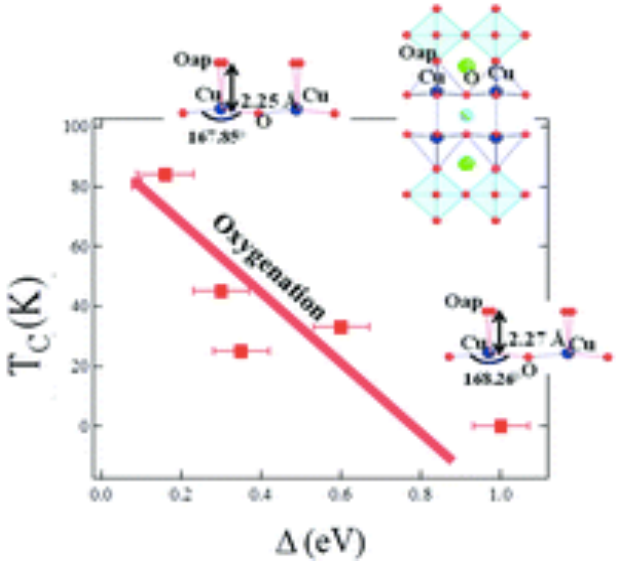
Publication Date (Web): February 15, 2010 (Article)

DOI: 10.1021/ic902228h

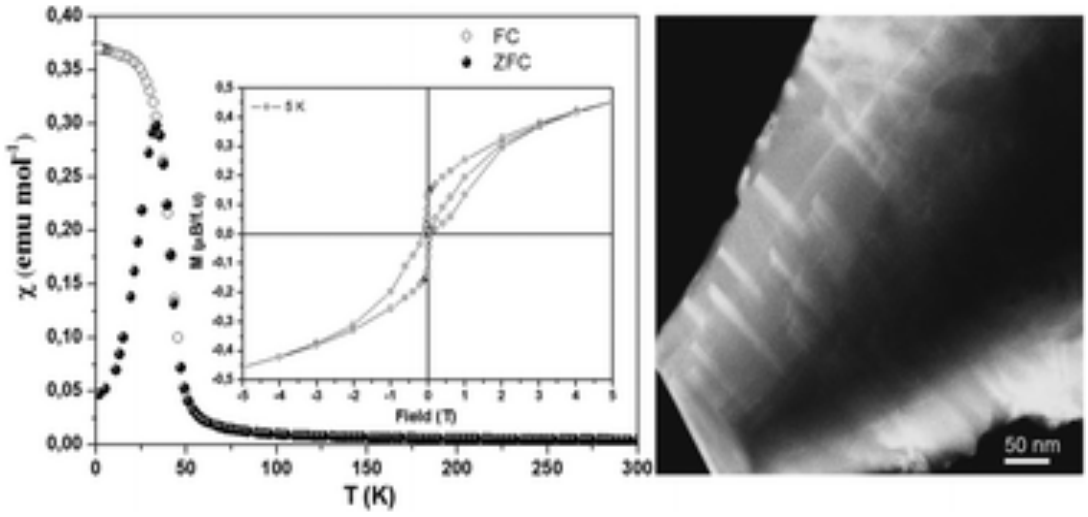
The $CdCr_2O_4$ spinel transforms to a 10.6% denser new polymorph of the $CaFe_2O_4$-type structure at 10 GPa and 1100 °C. This new polymorph has a honeycomb-like structure because of double rutile-type chains formed by [Cr−O_6] edge-shared octehedra.



Core-level photoemission spectra of $Mo_{0.3}Cu_{0.7}Sr_2ErCu_2Oy$, a superconducting perovskite derivative. Unconventional structure–property relationships Dalton Trans., 2015,44, 10795-10805 Sourav Marik, Christine Labrugere, O. Toulemonde, Emilio Morán and M. A. Alario-Franco:
The correlation between the critical temperature, Tc, and the apical oxygen distance, the buckling angle and the charge transfer energy (Δ) with the oxidation, in the family of materials: $Mo_{0.3}Cu_{0.7}Sr_2ErCu_2Oy$.



<u>High-pressure synthesis, structural and complex magnetic properties of the ordered double perovskite Pb_2NiReO_6</u> *Dalton Trans.*, 2014,43, 1117-1124
Teodora Stoyanova-Lyubenova, Antonio J. Dos santos-García, Esteban Urones-Garrote, María José Torralvo and Miguel Á. Alario-Franco.
Wasp-waisted hysteresis loops are originated from the AFM/FM competing interactions occurring in the compositional microdomains of the Pb_2NiReO_6perovskite.



Acta Cryst. (1982). A**38**, 177–186

Structural Studies on *A*-Cation-Deficient Perovskite-Related Phases. I. $ThNb_4O_{12}$. Thorium/Vacancy Ordering in Slow-Cooled Samples

By M. A. Alario-Franco

Departamento de Quimica Inorgánica, Facultad de Ciencias Quimicas, Universidad Complutense, Madrid-3, Spain

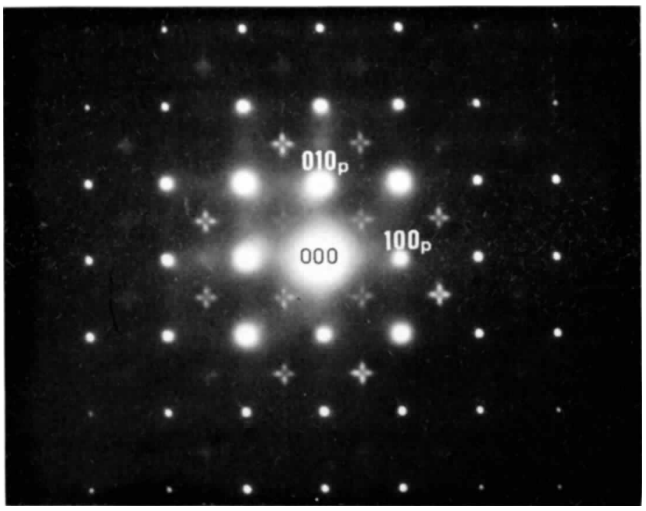
I. E. Grey,* J. C. Joubert and H. Vincent

Laboratoire de Cristallographie, CNRS, 166 X, 38042 Grenoble Cedex, France

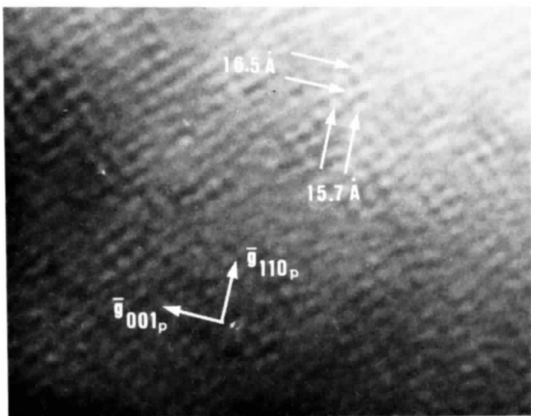
and M. Labeau

Institut National Polytechnique de Grenoble, Laboratoire de Génie Physique, BP 46, 38042-St Martin d'Heres, France

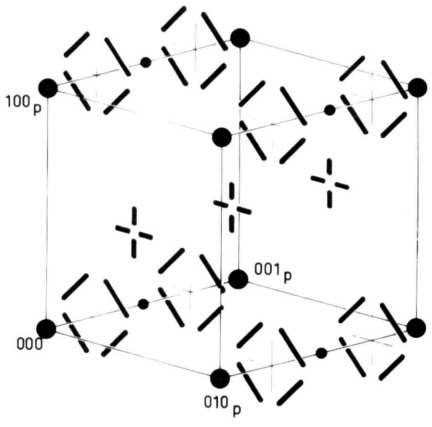
(*Received* 11 *June* 1980; *accepted* 7 *July* 1981)



[001] zone axis electron diffraction pattern

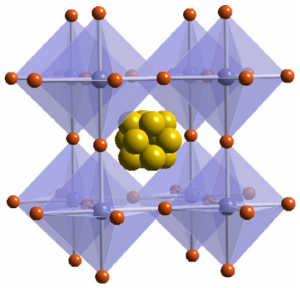


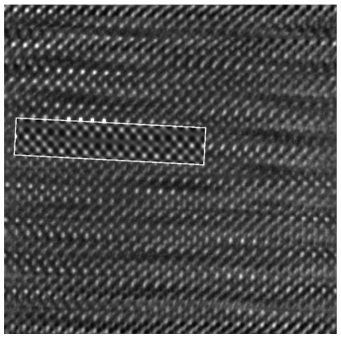
Microdomain texture



Reciprocal lattice

THE "STARS" COME FROM THE PERIODICITY OF THE WALLS OF THE PERPENDICULAR CRYSTALLINE MICRO-DOMAINS





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Journal of Solid State Chemistry 180 (2007) 3271–3279

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On the structure and microstructure of "$PbCrO_3$"

Ángel M. Arévalo-López, Miguel Á. Alario-Franco*

Departamento de Química Inorgánica, Facultad de Químicas, Universidad Complutense de Madrid, 28040 Madrid, Spain

Received 4 June 2007; received in revised form 11 September 2007; accepted 15 September 2007
Available online 22 September 2007

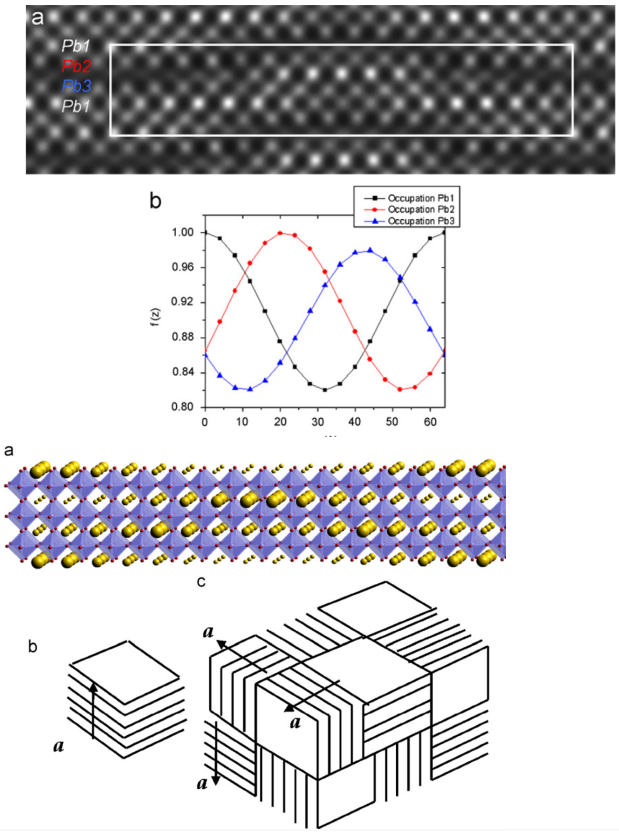


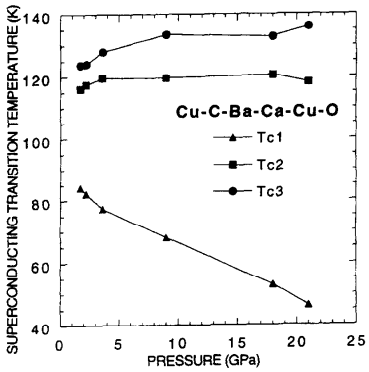
Fig. 12. (a) Model of the structure of $PbCrO_3$ obtained by electron microscopy and diffraction. The occupation factor of the Pb atoms has been scaled so as to make it more clearly visible. Lead is yellow, chromium is purple and oxygen is red (color online). (b) Single domain of a schematic representation of the microdomain texture of "$PbCrO_3$". (c) Intergrowth of domains in different orientations.

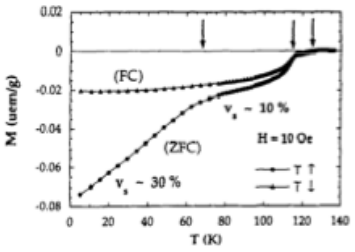
The influence of pressure on the superconducting properties of the family of HTSC materials (Cu_xC_{1-x}) $Ba_2Ca_{n-1}Cu_nOy$.

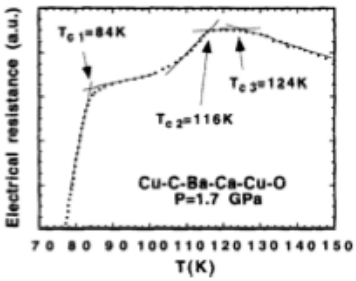
M. Jaime, M. Nunez Regueiro,* M.A. Alario-Franco*, C. Chaillout, J.J. Capponi, A. Sulpice, J.L. Tholence, S. de Brion, P. Bordet, M. Marezio, J. Chenavas, B. Souletie

Solid State Communications, Vol. 97, No. 2, pp. 13 l-135, ***1996***.

Samples of the $(Cu_xCl_{1-x})Ba_2Ca_{n-1}Cu_nO_y$ family have been prepared under various conditions to obtain the n=3 (Tc=8OK), n=4 (Tc=l17 K) phases, and sequences going up to n=7. Moreover, a minority phase with ***Tc as high as 127 K*** is observed in samples prepared under a pressure of 8GPa. An applied pressure has the strongest effect on this high Tc which reaches ***136 K under 21GPa in resistivity measurements.***







These materials, although difficult to made, are still the highest Tc Non-Toxic Superconducting Cuprates ever prepared, both at room Pressure: Tc = 127 K and under very high pressure: Tc = 136 K (under 21 GPa).

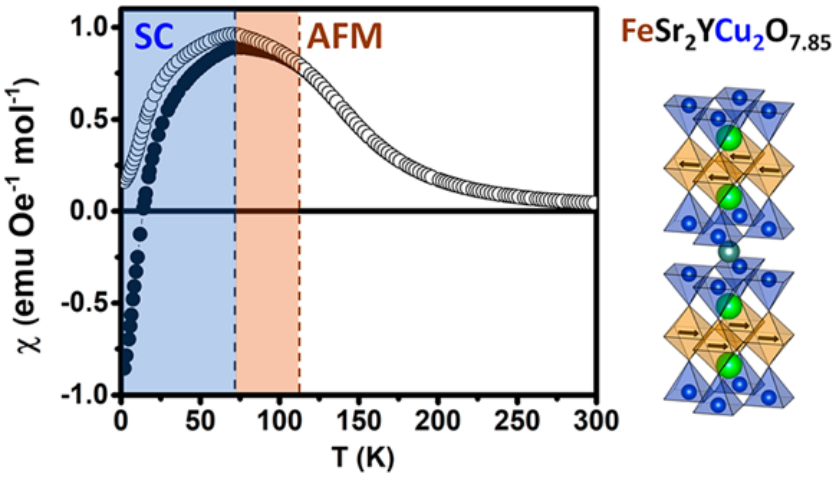
***See also: High Temperature Superconducting Materials. M.A. Alario-Franco: Adv.Mater.*1995, *7*(2) 229-232.**

Progress in the preparation of new materials has been impressive in the eight years that have elapsed since Bednorz and Muller's discovery. Yet, in both structural and compositional terms, we have simply, using a musical para- phrase, "variations on an original theme": superconducting copper-oxygen layers (SCLs), supported by a perovskite skeleton (PS), and supplied with charge by the charge reservoir layers (CRLs). Chemical ingenuity has, once again, greatly improved the HTSC materials. Yet, if a new theme could be found...

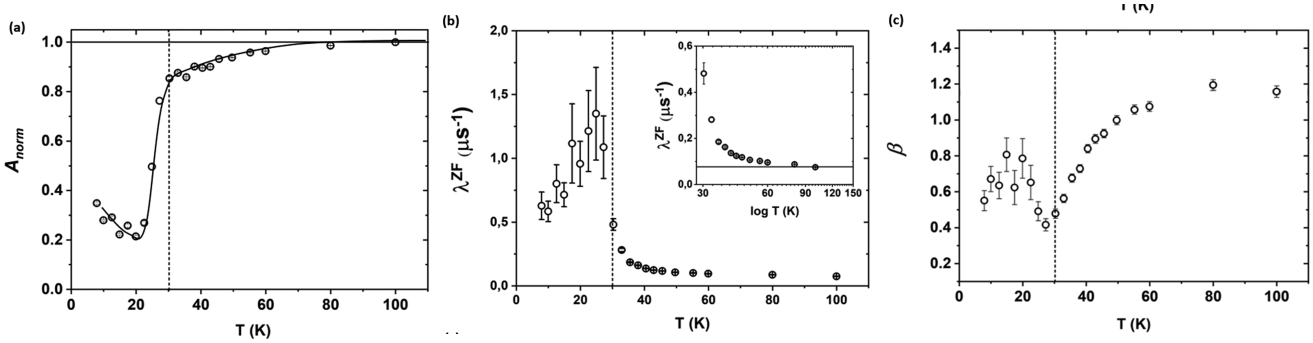
The last two publications

Soft Magnetic Switching in a $FeSr_2YCu_2O_{7.85}$ Superconductor with Unusually High Iron Valence. Sara A. Lopez-Paz, Xabier Martínez deIrujo-Labalde, Jorge Sańchez-Marcos, Clemens Ritter, Emilio Moran, and ***Miguel A. Alario-Franco***
DOI: 10.1021/acs.inorgchem.9b01770 Inorg. Chem. 2019, 58, 12809−12814

ABSTRACT: Ozone oxidation has allowed the stabilization of a very high iron oxidation state in the $FeSr_2YCu_2O_{7.85}$ cuprate, in which a long-range magnetic ordering of the high valent iron cations coexists with the superconducting interactions (magnetic ordering temperature $T_N = 110$ K > superconducting critical temperature $T_c = 70$ K). The somewhat unexpected A-type AFM structure, with a $\mu(Fe) \sim 2\ \mu_B$ magnetic saturation moment associated with the hypervalent iron sublattice, suggests an unusual low spin state for the iron cations, while the low dimensionality of the magnetic structure results in a soft switching toward ferromagnetism under small external magnetic fields. discussed.



Coexistence of magnetism and superconductivity in the iron containing $FeSr_2YCu_2O_{7.57}$ cuprate as studied by μSR.
Sara A. López-Paz, D. P. Sari, A. D. Hillier, and M. A. Alario-Franco **AIP Advances 11**, 015011(2021).
ABSTRACT: Substitution of copper by iron in the charge reservoir block of the $YSr_2Cu_3O_{6+\delta}$ (YSCO) cuprate superconductor brings out an appealing insight on the interplay between superconductivity and magnetism. In the resulting $FeSr_2YCu_2O_{7+\delta}$ (Fe-1212) materials, $FeO_{1+\delta}$ layers and CuO_2 bi-layers are alternated along the stacking direction, in close analogy to the $RuSr_2GdCu_2O_8$ (Ru-1212) ferromagnetic superconductor. For the $FeSr_2YCu_2O_{7.57}$ compound, both BVS calculations and spectroscopic data reflect a high doping level in the superconducting planes of pCuO2 ~ 0.30, placing this cuprate on the overdoped region of the conventional phase diagram for cuprate superconductors. 3.6+. Nonetheless, iron cations in the charge reservoir block (CRB) are quite oxidized, reaching a high formal oxidation state of $Fe^{3.6+}$.



Temperature dependence of (a) the normalized asymmetry (b) the relaxation rate and (c) exponent β for the $FeSr_2YCu_2O_{7.57}$ compound, as derived from fitting of the ZF-μSR spectra using *Eq.* 2. The superconducting critical temperature (Tc = 30 K) is indicated by a vertical dashed line. This highly doped $FeSr_2YCu_2O_{7.57}$ cuprate is superconducting below Tc = 30 K and, from our muon spin relaxation spectroscopy (μSR) study, the presence of magnetic interactions has been substantiated. Most interestingly, the coincidence of the onset of the magnetic interactions with the superconducting critical temperature strongly ***suggests a complex interplay between magnetism and superconductivity*** in this over doped cuprate.

Editor Comments:
Dear Dr. Alario-Franco,

We're grateful that you chose to publish with us, and we're writing to share some performance figures collected over the past year for your article, Coexistence of magnetism and superconductivity in the iron containing $FeSr_2YCu_2O_{7.57}$ cuprate as studied by μSR.

Total Downloads: 1436

DOI: 10.1063/9.0000093. **Journal:** ***American Institute of Physics Advances.***

Date Published: January-2021

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Thank you for helping us deliver new, important work to the scientific community. We hope you'll submit your next research to us, too.
Sincerely, AIP Advances.
A very nice comment to end this publication choice…¡

13.-Patents

1.- Patente española de invención P.9000125:
"Superconductor Ionico obtenido por introducción de átomos de litio en la red de materiales supercondutores de alta temperatura tipo Ba2YCu307-x".
M. A. Alario y Franco, E. Morán, A. Várez, J. Santamaría y F. Sánchez Quesada. Presentada en el Registro de la Propiedad Industrial en enero 1990 y extendida a 16 países europeos en enero 1991.

2.-Patente francesa:

"Une nouvelle famille de supraconducteurs de haute température". M.A. Alario-Franco, C. Chaillout, J.J. Capponi, J.L. Tholence, B. Soulettie. (Adquirida por Alcatel al CNRS).

3.- Patente española de invención P9802655:
"Procedimiento de elaboración de películas sobre titanato de estroncio mediante técnicas electroquímicas, sin necesidad de capa metálica intermedia"
M.A. Alario Franco, E. Morán Miguélez y M.S. Martín González, Presentada en el Registro de la Propiedad Industrial en diciembre de 1998.
4.- Patente internacional:
"Oxide superconductor with transition temperature above 100k/comprises barium-calcium-copper oxide contg.silver@"
Patent number: WO9250550-A; EP741678-A; FR27115397-AI
Assignee: Cent. Nat. Rech. Sci.; Alcatel Alsthom Cie Gen Electrite
Iventor (s): Alario-Franco M.A.; Chillout C.; Capponi J., et al

14.-Summary of the scientific career: The building up of the required laboratories and the Teaching of S.-S. Chemistry

14-1.- Introduction

The work carried out in the fifty-seven years since the completion of the Chemistry degree (1965) began with the ***exciting*** task of the Master and Doctoral Theses. Both were directed by Professor Dr. Andrés Mata-Arjona, who, in addition to providing me with the work topic and the ideas to develop it, promoted my experimental training, by the *construction of the equipment* that, after the synthesis of hydrated aluminum phosphate-type materials, allowed us to perform the thermal treatments of the samples in vacuum and the measurement of their porous texture.:

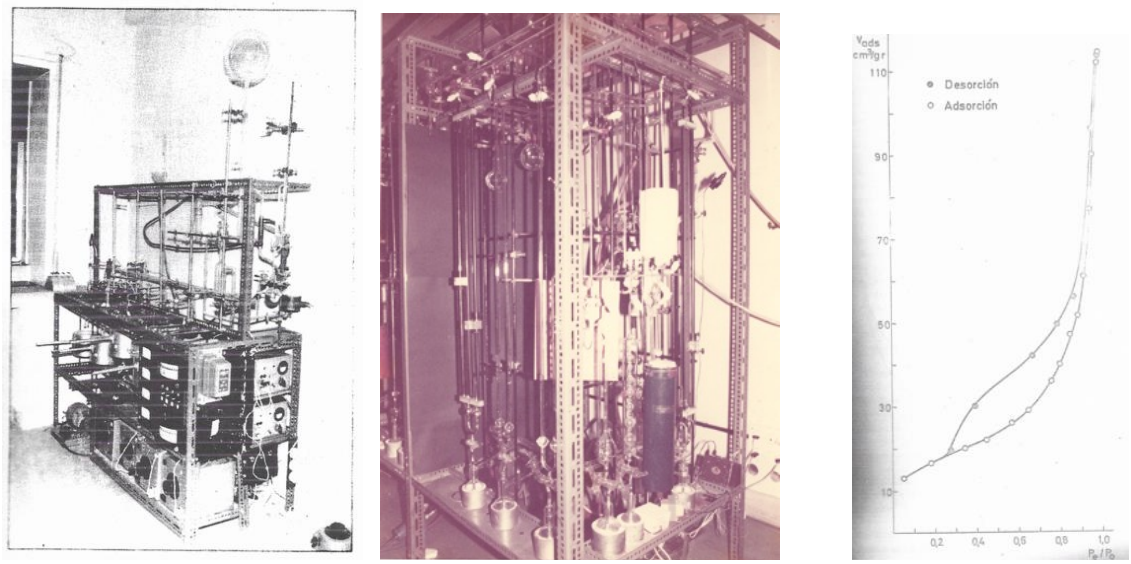


Figure 2.- Home-made equipment for: *left,* the thermal treatment of the samples under vacuum, *center*, the measurement of adsorption isotherms at liquid nitrogen temperatures;

right, an adsorption-desorption isotherm **(1966-1970).** ***Built by M. A. Alario Franco supervised by Prof. Andrés Mata.***

These two pieces of apparatus, *which I did built practically by myself*, essentially by hand and starting virtually from scratch, in a ***literarily empty room*** where, with the sole aid of an expert glass blower and a part-time technician, later served, for more than twenty years, to carry out several other dissertations & doctoral theses and scientific work, in my own group and even in other research groups. Moreover, the first one was later "converted" to a hydrothermal synthesis equipment in the High-Pressure Laboratory that we set up years later, (see below figure 3).

Subsequently, the postdoctoral period in Great Britain took me, using a metaphorical language, to the *"inside"* of the solid, of which, it can be said, continuing the metaphor, that until then we had only covered the surface and learned something about the dehydration processes of the gels, and therefore their reactivity. Reactivity that, on the other hand, has also been important in our work. Indeed, the ***Reactivity of Solids*** was the theme of the first International Congress (In Bristol, UK, 1972) in which I presented an extensive communication; it was also the theme of the first International Committee for which I was elected - and I continue to be- a member - and it was also the theme of the first important International Congress that I organized and presided over, in Madrid, in 1992.

My "discovery" that solid also had a Chemistry -I mean a specific Chemistry, largely different from that of liquids and gases, today called Solid-State Chemistry- that was by then, in the early seventies, an incipient *"New Chemistry"* and it has marked the rest of my career until now.

Upon my return to the Department of Inorganic Chemistry of Complutense University of Madrid, which in its geographical, managerial and thematic aspects coincided with the Elhuyar Institute of the ***CSIC (Higher Council for Scientific Research in Spain)*** I did gave myself the task of starting the implementation and later the development in Spain, but not only in it, of this by then *"new born"* ***Solid-State Chemistry***. And, along this path I believe to have contributed in a significant way to the growth of the aforementioned discipline at an international level. To this end, the work carried out since 1973 was developed out of two fronts:

On the one hand, with the creation of a research group in which several doctoral theses (more than 25-see below) have been carried out and from which many students and disciples have emerged who, immediately afterwards went to important foreign research centres, where that still relatively *new* Chemistry that we have defined as "***the Chemistry that solids present as such, different from that of liquids and gases"***, was also emerging. The subsequent return of practically all of this first *"armada"* to our nascent group made this the ***earliest and most important team in Spain, and one of the earlier in Europe***, in these disciplines and has had a notorious international relevance. Later on, many of these doctors ***(See Section 3·- above)*** established themselves on their own in different universities and research centres in and out of Spain. ***The seed, then, bore fruit widely.***

On the other hand, the development of a new (in 1973) **academic discipline**, **Solid-State Chemistry**, as a university subject in its theoretical and practical aspects, hitherto unknown in Spain, and even in most of Europe, allowed us disseminating an original and growing teaching program, to which some aspects have been added from, the closely related, Solid State Physics, Mineralogy, Crystallography..., to lead to many of the basic aspects of Materials Science. This subject exists today in the curricula of most degrees in Chemical Sciences, Engineering and Materials Science, largely due to the influence that our group has had on its initial development in Spain. The Program for this subject, in force at the Faculty of Chemical Sciences of Complutense University and several other Spanish universities, is included below (see paragraph 20-2-H) and reveals the evident synergy between the teaching and research aspects of our scientific career.

14-2.-Research Lines developed in our Laboratory: Solid State Chemistry and Materials Science

A) Synthesis of multiple oxides by conventional methods and especially at High Pressure and High Temperature, including the development, in 1981, of a ***Hydrothermal Synthesis*** homemade equipment, Figure 3 with autoclaves up to 2.5 kbar. This was, in fact the embryo of the *Laboratorio Complutense de Altas Presiones* ("*Complutense's High Pressure Laboratory*":***https://www.ucm.es/labcoap/***) *set up in 1995.* This laboratory, still *unique in Spain*, is devoted to the synthesis under high pressures (up to 100 kbar) together with simultaneous high temperatures (up to 1600 K*)* in order to obtain new inorganic materials and, in particular, high T_c superconductors.

Autoclaves

Figure 3: *Left: vacuum or gas furnace (CNRS). Right: Hydrothermal synthesis system. (*M.Á. Alario Franco & Emilio Morán)

B) Characterization This essential aspect was complemented by a very wide use of Structural and Micro-structural Characterization Techniques: X-ray and neutron diffraction, TGA, magnetic measurements (including a Faraday Balance and later a SQUID magnetometer and a PPMS that, patiently, we could purchase step by step) and, in particular, High Resolution Electron Microscopy and the ancillary techniques like, Electron Diffraction, EDX, EELS…This also required the creation and start-up of an

Electron Microscopy Laboratory, at first in the *Elhuyar Institute* of the CSIC, in 1975, with two *Siemens Elmiskop* microscopes at a 100kV.

Subsequently, in 1986, we did set up the "*Luis Bru" Electron Microscopy Center of Complutense University* with two *JEOL* microscopes one for 200 kV and the other up to 400 kV. This, Figure 4, was the first High Resolution Electron Microscope installed in Spain and had a resolution of 0.17 nm. In that, we were again the pioneers in chemical laboratories in Spain and, indeed, in most of Europe.

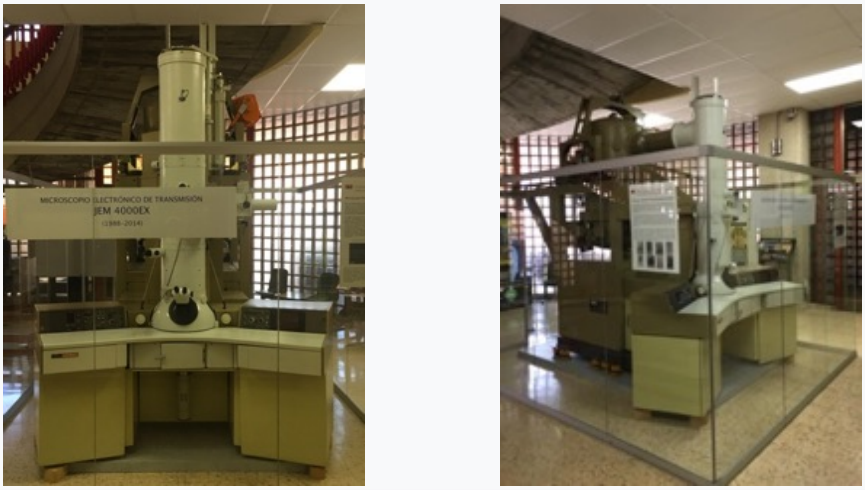


Figure 4.-The first *HRTEM MICROSCOPE (400 kV)* installed in the Luis Bru Center for Electron microscopy (1988)

As an example of the possibilities of this magnificent piece of equipment, we show below an Electron Diffraction Pattern and the corresponding HREM Images of a multidomain incommensurate structure in $PbCrO_3$. Figure 5, below:

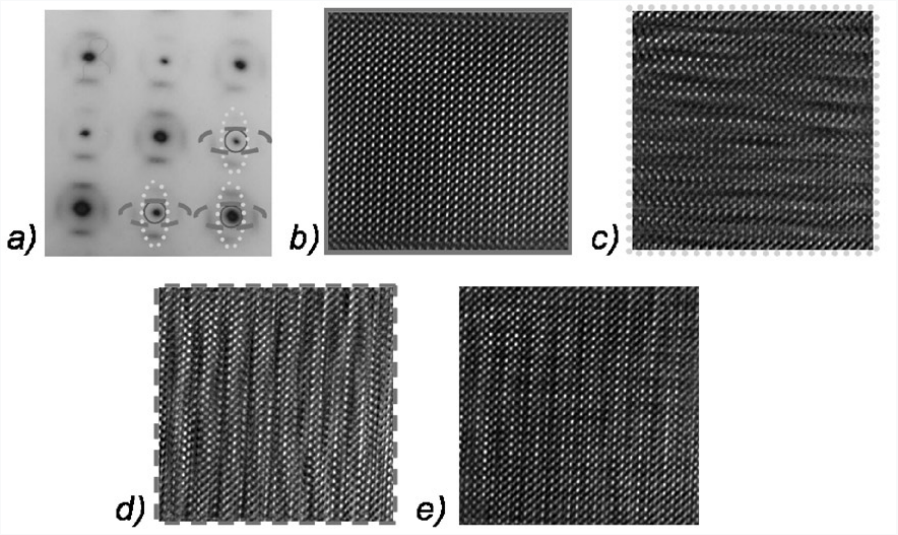


Figure 5.-

a) Electron diffraction of the $[001]_p$ zone axis in $PbCrO_3$. b) experimental general image. c) and d) experimental images using the masks shown in a) so as to discern the perpendicular domains stucture e) Adding the domains obtained in c) & d) one recovers the image obtained experimentally as a superposition of the, so confirmed, perpendicular dmain structure. Details in *Bol. Soc. Esp. Ceram. V. 49, 1, 1-6 (2010)*

C) Setting up a Solid-State Electrochemistry Laboratory for various processes such as Metal Insertion, Electrodeposition, Lithium Ionic Conductivity. Electrochemical Oxidation-Reduction processes in solid and liquid medium, and also using materials in the electrodes to modify their structure and properties.

D) ***Building of a High oxygen pressure*** facility. For this, essential, technique in Solid State Chemistry and Materials Science, besides the use of oxidating materials in the Belt type Press in the H.P Lab, we did set up a homemade ***Ozonation system*** included in a tubular furnace.

With this plethora of experimental techniques, we did endeavour the search for new functional materials and the study of their very diverse electrical, electronic, and magnetic properties, including multiple oxides of different metallic elements, by means of their structural, micro-structural characterization (X-ray, electrons, neutrons diffraction, high-resolution electron microscopy, and ancillary techniques such as EELS, XPS, STEM and SBM) and the measurement of their electrical, magnetic, specific heat properties, etc.

E) ***Search for Functional materials***: *According to FIZ/NIST Inorganic Crystal Structure Data Base*, ***more than one hundred and fifty-five novel materials have been prepared in the group)***: Catalysts, ionic conductors, NTE Materials, materials for fuel cell: electrodes & electrolytes, materials for batteries, electronic conductors, ferroelectric, ferromagnetic, multifunctional & ***especially HTSC*** *(High Temperature Superconductors &* some *Mixed Ionic & Superconducting Material). See next paragraph*

F) Very prompt work in HTSC ***cuprates-*** Among the very many materials prepared we would like to highlight the establishing and developing the ***earliest line*** of research in Spain in High Temperature Superconducting Cuprates, where we did attain, non-less than ***three milestones***:

****Tc record*** of 96.5 K for $SmBa_2Cu_3O_7$ (Solid State Comm. 63 (6), 507-510 (1987)) Highest Tc for an YBCO superconductor. ***The first HTSC made in Spain***

****The intermediate phase*** $Y_2Ba_4Cu_6O_{13}$ (Solid State.Comm.**65,** 283-6, (81988/1/1)

****A new family of cupro-carbonates*** (Physica C, **1-2,** 52-6(1994) & Physica C,**235-240**, 975-6 (1994). Which is still the High Tc Record for non-toxic materials:117K.

The last two, were developed in a close collaboration with the *Laboratoire de Cristalographie CNRS. Grenoble. A few more important examples outside SC are shown below, section 22.*

G) Highlights of the Research work on HTSC

Professor Miguel Á. Alario-Franco has substantially contributed to the knowledge of High Temperature Superconductors both in the synthesis of new materials and in the study

of the oxygen content in Cuprates and its influence in the structural, compositional and superconducting properties; in particular the critical temperature: Tc.

As just mentioned, some of the highlights of this work are as follows: In the late eighties, his group prepared the new **$Ba_2SmCu_3O_{7-x}$,** with the ***then record of Tc = 96.5 K*** *(Mat. Res. Bulletin 23 (3), 313 (1987))* and established the ***nature of the ordered orthorhombic phase*** at mid oxygen composition *(Phys. Rev. B 36 (13), 12 7118 (1987)).* Of the same period is the work reporting the first single crystal growth and structure determination of **$Ba_2PrCu_3O_7$** and a ***discussion of its non-superconducting character*** (Solid State Comm. 67(4) 369 (1988). Later on, his work encompasses, from the discovery of a new family of non-toxic superconductors: **$CuBa_2Ca_{n-1}Cu_nO_{2n+2+x}$**. (*Physica C: Superconductivity 222 (1- 2), 52-56(1994)* to the influence of pressure in SC cuprates *(Solid.State Comm. 9 (2), 131-135(1995).* The Tc attained in this system, 120 K, still stands as a ***record for nontoxic cuprates under pressure***.

Our work has also demonstrated ***a novel Red/Ox mechanism*** in the oxidation –and concomitant very marked increase in Tc- of cuprates having two different transition metals: **$Mo_{0.3}Cu_{0.7}Sr_2RECu_2O_{7+x}$** *(Dalton Transactions: 44(23) 10795- 805(2015))*. The recent study of Alario-Franco *et al* of the influence of very high oxygen pressure in the structure, ***electronic properties and critical temperatures of those molibdo-cuprates, is both original and very relevant to the understanding of superconducting materials***: In such a work, the very subtle structural modifications originated in the oxidation process, appear to be closely related to, both, cationic and anionic disorder and the inter-bilayer/intra-bilayer distances balance, associated to the apical distance. Even more, ***this can be related to the increase in Tc through the transfer of charge as determined, in the bulk***, ***by means of EELS*** (Presented at Symposium "Towards Room Temperature Superconductivity" Chapman University, Orange Ca (USA): 5/8/2017- 5/9/2017. Publication: *Quantum Stud: Math. Found. 5, 65 (2018).*

In another remarkable publication: *Dalton Transactions (2017) DOI: 10.1039/c7dt01974b*, a very detailed analysis is performed, for the first time, of the ***influence of nanoparticle size in the presence, and the coexistence, of magnetism and superconductivity*** in ***YBCO*** and their suppression by a magnetic field. In a subsequent paper of the group*, Inorg. Chem. 57 (19), 12038–12049 (2018),* the influence of the Rare Earth on the superconducting properties of the Transition Element substituted $Mo_xCu_{1-x}Sr_2RECu_2O_y$ cuprates has been explained. ***Selecting three groups of RE elements attending to their different size***: small atoms (Yb and Tm), medium one (Gd) and big ones (Nd and Pr) and with the use of Atomic Resolution TEM, X-ray, neutrons and electron diffraction and spectroscopic analysis, we ***have demonstrated that the increase of structural disorder in either anionic or cationic disorder***, complemented with a decrease in the hole content, ***play a major role*** in the vanishing of superconductivity in this type of system.

More recent work concerns ***the use of various oxidation processes*** O_2 up to 80 Kbar; O_3; chemical & electrochemical oxidation of cuprates, in the system

$M_xCu_{1-x}Sr_2RECu_2O_{7+\delta}$ (M = Mo and Fe) ***trying to produce permanent structural modifications,*** related to the apical oxygen distance, ***analogous to those transiently observed by*** pump and probe irradiation experiments in the THZ range, that put YBCO Tc over Room Temperature in the celebrated, work of ***Cavallieri et al***. ***Very promising results have been obtained.***

On the other hand, the wide doping range explored for the $Mo_{0.3}Cu_{0.7}Sr_2TmCu_2O_{7+}$ and $FeSr_2YCu_2O_{7+d}$ systems allow the progressive variation of the superconducting and magnetic properties. The determined hole doping levels place these compounds on the **highly doped region of the conventional phase diagram of cuprate superconductors**, where the key role of the crystal structure in the superconducting properties has been highlighted. Moreover, the substitution of copper by iron leads to an **unusual coexistence of magnetism and superconductivity**, ***reinforcing the interest of M-1212 type compounds for the understanding of cuprate superconductors***. A graphical summary of these more recent results appears in the following figure

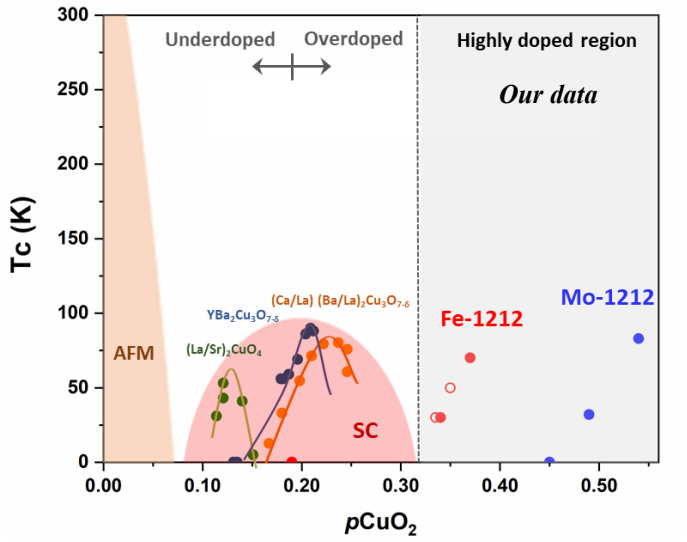


Figure 6.- Graphical summary of the (left) the standard phase diagram of the critical temperature of various different cuprate families as a function of hole doping. (right) Our data showing the very high doping range attained with our samples. This work is in progress so as to analyze the mobility of the carriers.

H) We have also helped the scientific community *at large* in two ways:

By supplying pure and often novel materials to several laboratories in Europe; Among them: Stuttgart (Cardona) Santiago (F. Vidal), Zaragoza (Rillo & Navarro), Barcelona (Obradors)…

By accepting/inviting researchers from several countries besides our own: France, Great Britain, Germany, USA, Argentina, Italy... and very particularly Mexico. In

fact, more than 20 Mexican scientists have worked in our research group along the years, see Part 6 and in particular 6-3 & 4 above

14-3.- Teaching of Solid-State Chemistry.

As mentioned Above **Paragraph 14-1**, giving the lack of a structured discipline, describing Solid-State Chemistry, we did prepare a series of lectures describing the main aspects of the knowledge necessary to be able to made solids and families of solids, to study them by all sorts of possible characterization, to make them react under the influence of temperature, pressure and both combined, temperature and low pressure. -vacuum-, temperature and/or pressure in different atmospheres, static or dynamic and so on. In parallel, we did prepare a series of experiments, from simple to complex that used these ideas in a practical work. Just as an example students will prepare and characterize a solid solution between two, and then three Corundum-type based oxides of aluminium, iron ad chromium; subsequent quantitative analysis by X-ray diffraction, magnetic properties, etc.

In this way, we actually set up a complete discipline comparable to the others more classical in the curricula of a degree in chemistry, like inorganic, organic, etc and, we are proud to say that it was very well received by the students.

A second part was developed for the doctorate that was, indeed more specialised, as can be seen in the corresponding program.

Official Program of the Solid-State Chemistry Course

Established in 1973 in both UCM & UAM (Autonomous University in Madrid).

Designed, developed and taught by Prof. Alario-Franco, at the UCM for 42 years (1973-2015) and at the UAM for two academic years (1973-74 and 1974-75)
Students for which it was developed: final year (5^{th}) of the degrees in Chemical Sciences and Materials Engineering
(At present, the degree consist of four years and this discipline is taught in the 4^{th} year).

I.- Solid State Chemistry

Introduction. The ideal solid: crystalline structures. Solid State Chemistry in Materials Science

II.- Electronic structure of solids.

Bands in solids. Electrical and magnetic properties. Structural families: Rock Salt, Rutile, Corundum, Perovskite... Metal Insulator Transitions (MIT) Goodenough model. Hoffman-Burdett model. Superconducting (HTSC) and Magneto-resistant (GMR/CMR) materials

III.- Phase diagrams

Definitions. Systems of one, two and three components.

IV.- Phase transitions

Introduction. Types. thermodynamic aspects. Kinetics of phase transitions. Order-disorder relationships

V.- Defects in solids

V-1.- Types of defects: Punctual, complex, linear, extended.
V-2.- Thermodynamics of defect formation.
V-3.- Thermal properties of solids: Phonons; specific heat.
V-4.- Colour centers
V-5.- Dislocations
V-6.- Extended structural defects
V-7.- Extended compositional defects

VI. - Non-stoichiometry

Concept. solid solutions
Thermodynamic and kinetic aspects
Incorporation modes of non-stoichiometry
Homologous series. Intergrowths
Infinitely adaptable structures
Influence of non-stoichiometry on the properties of solids.

VII.- Solid state reactions. Kinetics and reaction mechanisms.

Matter transport: diffusion in solids. Phenomenology: Diffusion mechanisms. Ionic conductivity.
Types of solid-state reactions:
Solid-gas reactions. Kinetics and reaction mechanisms.
Solid-solid reactions: Displacement reactions. Topotactic reactions.

VIII.-Doctoral Course
Superconductivity and Superconducting Materials (Since 1988…)

The Dawn of Superconductivity: From Mercury to A-15s
The fabulous world of *Cuprate* Superconductors
Copper-free superconductors.
"The Iron Age"
Pressure and superconductivity: Hydrogen
Transient superconductivity up to at room temperature…and beyond
1) Superconducting hydrides.
2) Optical stimulation of superconductivity
What are superconducting materials used for? A world of applications.

15.-OtherTeaching work

A brief consideration about participation in the teaching of Chemistry

In relation to teaching, it should be noted that, in addition to the aforementioned Solid-State Chemistry course, I have taught several other subjects in the Faculty of Chemical Sciences of our University: *General Chemistry, Basic Inorganic Chemistry, Advanced Inorganic Chemistry and Materials Chemistry*. Lectures, Tutorials, Seminars and Laboratory work over ***more than 40 years***; I estimate that I have taught to ***more than 9,500 students*****!**

Teaching at RCC-Harvard

Likewise, within our participation in the activities of the **Real Colegio Complutense at Harvard University, *https://rcc.harvard.edu/*** of whose Universidad Complutense/Harvard University academic council, I was a member from its inception in 1988, until 2014, I did participate in the organization and teaching classes on *"Atmospheric Chemistry, the Greenhouse Effect and the Ozone Hole"*, in the *"Postgraduate Course for Ibero-american Students on Environmental Sciences and Law"*; a course in which professors from both universities participated and in which, on two occasions, the Nobel Prize winner Mario Molina from MIT collaborated, and that took place in four consecutive summers starting in 1995.

16.- Some Postgraduate Courses abroad

-Transmission electron microscopy & diffraction:(Experiment and Theory
Laboratoire de Cristalographie CNRS Grenoble (1983) 3 days (Head. Prof. Bertaut)
-Extended Defects in Solids: Lomnonosov University, Moscou 1988 (1 week) (Head Prof. Tretiakov and Associate Prof. A. Kaul)
Defectos extensos en Sólidos no-metálicos. University of Bahia Blanca. Argentina (head Professor Bazán & and Associate Dr. Aurora Sagua (2003) & Department of Physics Universidad del Valle Cali Colombia (2005) (Head Professor Pedro Prieto and associate Professore María Elena Gómez.
Climate Change: Causes and Consequences. 4 days. Department of Chemistry. Northwestern University, Evanston Ill (USA) 2017. (Head Prof. Kenneth Poeppelmeier)

17.-Invitations as Plenary speaker at Jubilee symposia:

Professor CNR Rao, FRS, Indian Institute of Science: 60th (1994) and 70th (2004) *Birthdays Jubilee*. Bangalore (India).
Professor J. Gopalakhisnan *retiring Jubilee,* Department of Chemistry I.I.S. Bangalore (India) (2006).
Professor Mikio Takano, Department of Chemistry, Kyoto University, retiring (2011)
Prof. Sir John M. Thomas, FRS 75th *Birthday Jubilee*, Cambridge University (UK). March (2007); JMT *memorial*: March (2022)
Prof. Kazuko Maeda, Kyoto University, *retiring*, Toyota Museum, Kyoto 16-X-2017.
Professeur Alexandre Revcoleschi, *Université de Paris-Sud Orsay : retiring jubilee 18-XII-2014.*

Professeur Paul Hagenmuller, "Hommage à Paul Hagenmuller" : Institute de Chimie de la Matière Condensée Bordeaux (France) 26 March 2018.

***Professor John B. Goodenough: Nobel Prize in Chemistry in 2019: Centenarian of Energy innovation**: Goodenough 100th birthday Symposium: Cokrell School of Engineering. University of Texas at Austin*

July 22-24-2022

18.-Miscelanea

18-1.-Tributes on the Sixtieth birthday

As a High-moment of this academic CV, I would like to point out that, on the occasion of my sixtieth birthday, a one-day Symposium session was held at the Faculty of Chemical Sciences of Complutense University, in which, in addition to my Thesis supervisor, the late Professor D. Andrés Mata Arjona, a great many of my disciples and some colleagues kindly presented some of their research work on Solid-State Chemistry. The program of the meeting is set out below.

Miguel Ángel Alario, Premio Investigación *Jaime I*, 1991

MAAF-60: Programa

Moderador: Emilio Morán. (UCM)

9.50: *Presentación.*
10.00: *Andrés Mata Arjona (U. Granada): "Lo que el viento no se llevó".*
10.15: *Antonio Jerez Méndez (UNED)*
10.30: *María Vallet Regí (UCM) : "Sólido inorgánico y biocompatible: ¿es posible?"*
10.45: *María José Torralvo Fernández (UCM): "Del micro al macroporo: un largo camino"*
11.00: *Luis Carlos Otero Díaz (UCM): "La microscopía electrónica a finales de los setenta: defectos extensos y su ordenación"*
11.15: *Regino Sáez Puche (UCM): "Magnetismo y Química del Estado Sólido"*
11.30: *José María González Calbet (UCM): "Intercrecer, dominar y otras formas de enredar"*
11.45: *Pausa-Café*
12.00: *Susana García Martín (UCM): "La imagen de alta resolución: importancia e interpretación"*
12.15: *Flaviana García Alvarado (U.San Pablo-CEU): "Baterías y Utopías"*
12.30: *María Antonia Señarís Rodríguez (U. La Coruña): "Aventuras y desventuras con perovskitas de cobalto y afines"*
12.45: *Alejandro Várez Álvarez (U. Carlos III): "Litio: un desafío estructural"*
13.00: *Catherine Bougerol Chaillout (CNRS, Grenoble): "Superconducting bismuthates"*
13.30: *Jose Luis Vicent López (UCM): "¿Existen realmente los vórtices superconductores?"*
13.45: *Teófilo Rojo Aparicio (UPV-Bilbao): "El Grupo de Química del Estado Sólido: historia de una ilusión"*
14.00: *Antonio Fernández Rañada (UCM): "A vueltas con la Ciencia en España: el Manifiesto de El Escorial"*
14.15: *Conclusión.*
15.15: *Comida.*

Also, on the occasion of this anniversary, three Mexican scientists: Pablo de la Mora, Miguel Castro and Gustavo Tavizón, from the Faculties of Physics and Chemistry of the National Autonomous University of Mexico, ***dedicated to me an article*** in the Journal of Solid-State Chemistry:

Volume 169, Issue 2, December 2002, p 168-175.

Comparative study of the electronic structure of alkali-earth borides (MeB_2; Me <> Mg, Al, Zr, Nb & Ta) and their normal state conductivity.

Abstract

By means of density functional theory the electronic structure of the MgB_2 superconductor was characterized and compared with that of the related iso-structural systems: AlB_2, ZrB_2, NbB_2, and TaB_2. Using the full potential-linearized augmented plane wave (FP-LAPW) method and the generalized gradient approximation, the electronic density distribution, density of states, and band structures were obtained for these compounds. The electrical conductivity, which cannot be easily measured in the c-direction, was calculated, in the relaxation time approximation using band structure results. It was found that the two-dimensional (2D) crystal structure character of these metallic diborides is also reflected in the electronic charge distribution. This 2D pattern is not reproduced in the electrical conductivity as it is, for instance, in the superconductor high T_c cuprates. The calculations indicate a bulk, yet anisotropic, conductivity for all these compound

18-2.-Tributes on the Eightieth birthday

18-2.-A: -International Symposium in Honour of Prof. Alario-Franco in Madrid UCM (6-8)-X-2022

Following this line of celebrations, it is also interesting to mention that, just this present year of 2022, on the occasion of my eightieth birthday an International Symposium has been organized by the same research group that I founded, several of whose components were indeed my students.

The symposium is entitled: ***"From Solid State Chemistry to Materials Science and Technology: A tribute to Professor Dr. Miguel Angel Alario -Franco, Emeritus Professor at Complutense University in his eightieth birthday".*** It will take place the 6th, 7th & 8th of October of 2022 in the Faculty of Chemistry of Complutense University, with the participation of around 25 distinguished international Solid- State scientists.

PROGRAM

18-2.-B: Journal of Solid-State Chemistry Special Issue in Honour of Prof. Alario-Franco.

This Festschrift is entitled: Synthesis, Structure and Microstructure of Novel Non-molecular Materials - Dedicated to Prof. Miguel Ángel Alario-Franco on the occasion of his 80th Birthday. It is being edited by Elizabeth Castillo-Martínez, David Ávila-Brande, Jesús Prado-Gonjal & Elena M. Mesa-Bribián, some of my long-date collaborators and friends. The dedication of this special issue reads: To Professor Alario-Franco on his 80th birthday. A pioneer in Solid State Chemistry from the mid-seventies, his notorious contributions to the field encompass the synthesis of novel materials, from room to high pressures and their characterization at the structural and microstructural level by means of TEM/ED & HREM. This implied the setting up of an Electron Microscopy Centre and a High-Pressure Laboratory, among the first of its kind in Europe, as well as the training of a significant number of international bright students that are disseminating the knowledge of the Chemistry of Materials and their inherent fundamental properties.

18-2.-C: Alario-Franco International Symposium on Solid-State Chemistry in Phuket, Thailand 27-XI to 1-XII-2022

(Program in Preparation)

19.-Hobbies

Talking, chatting, reading novels and essays, classical music, cinema, theatre, lecturing, science divulgation, swimming, traveling, visiting museums, watching moto racing & athletics…

20.-In conclusion

The preceding pages reflect, in a moderately detailed way, the scientific and academic career - in fact, a substantial portion of a life¡- of Professor Dr. Miguel Ángel Alario-Franco. Someone who, although he had to work hard to achieve it, he did also have the *luck* that Confucius anticipated to achieve happiness – or, rather, an important part of happiness, since there are many other interesting and important things in life besides work

"Find a job you love and you'll never have to work¡"

I found that job and, although I have had to work a lot, it never seemed like a punishment to me-; let us remember that, according with the dictionary of the Royal Academy of the Spanish Language: ***work is*** a "*patrimonial voice of the vulgar Latin tripaliare 'torture', derived from the late Latin tripalium 'kind of stocks or instrument of torture', composed of three 'three' and palus 'post, stake', for the three crossed pieces of wood that formed said instrument, to which the prisoner was tied".*

Those "*many! other interesting and important things"* are, very first of all, the family, but also friends, love, teachers, disciples, culture: that is, science, the humanities, art and, as Beethoven tells us with his sixth symphony, "The Pastoral*": Awakening of cheerful feelings on arrival in the countryside. That is, then:* ***Nature¡.***

In any case, having had the opportunity of sharing reflections, thoughts and hours and hours of conversation and discussions with non-less than the 200 interesting scientist that have been with us in the long adventure that has been the history of the Solid-State Chemistry group of Complutense University, indeed, my own story, was worth much more than the time and effort that it took: 48 years. Long live to the numerous and more than promising scientists that are taking over.

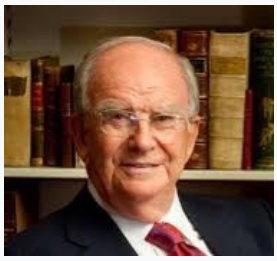
21.-Some Images to remember

Photographs of Professor Alario with various Chemistry Nobel Prize distinguished scientists: Mario Molina (1995), Sir Harry Kroto (1996), Roald Hoffman (1981), John B. Goodenough (2020) and Stanley Whittingham (2020) who have visited and gave lectures in his research group.

Elementary School, Carabanchel Bajo, Madrid, 1947

San Isidro High School Madrid VI-1957
Retiring of my first Chemistry Professor, D. Faustino Moreno
(Eighty students in the class¡¡¡)

Inorganic Chemistry Laboratory
Facultad de Ciencias Universidad Complutense (1961)



Post-doc in the University College of Wales: Aberystwyth (1972)
With Sir John Meurig Thomas FRS.

Gordon Research Conference in Solid-State Chemistry. Plymouth NH (VII-1990) Raveau, Honig, Thomas, Cheetham, Jacobson, Bartlett, Rouxel, Buttrey, Siegrist, Alario-Franco. First plenary lecture invitation to the GRC

Presentation to the Spanish King, HM Juan Carlos I, of the *El Escorial Manifesto on Science in Spain 1996*

Lomonosov University, Moscou 1988
Post graduate teaching and HTSC congress Plenary Lecture

International Symposium on the Reactivity of Solids.
Madrid 1992. Chair: M.Á. Alario-Franco

Left to Right
Row 1: K. Poeppelmeier, R. Denning, M. Kanatzidis, M. Rosseinsky, A. Navrotsky, M. Whangbo, M. Alario-Franco, J. Attfield, A. Kaminskii, J. Tarascon, B. Dunn, L. Nazar, E. Antipov.

Gordon Research Conference. "Solid State Chemistry" Oxford 2003.
Chair: M.Á Alario -Franco

President Royal Academy of Sciences of Spain 2009-2012

Honorary Fellow. University of Aberystwyth. (2015)
With Vice-Chancellor and Provost

With Professors. Emilio Morán & Harry Kroto
El Escorial Summer School of UCM (1995)

Solid-State Chemistry Group of Universidad Complutense

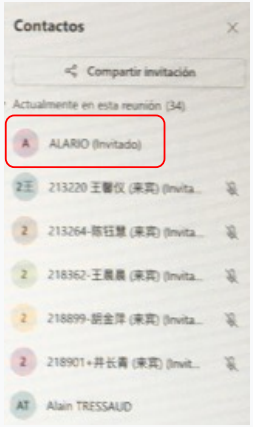
XII-2014

VII-2016

II-2018

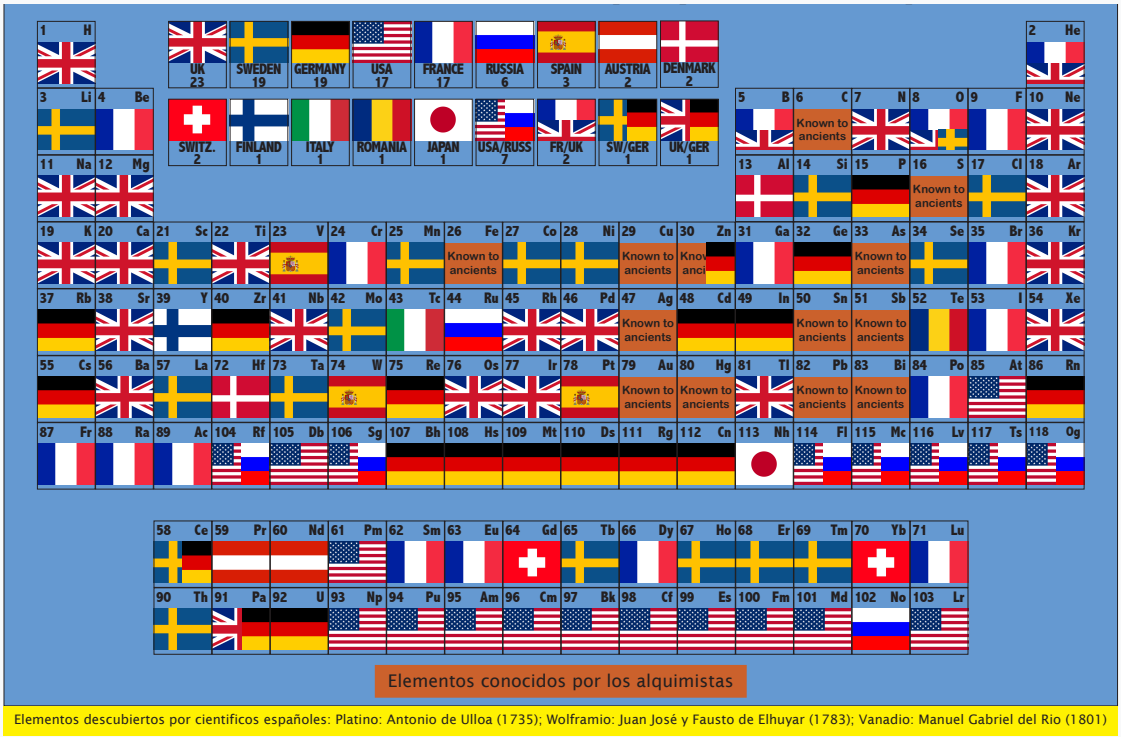
X-2019

Last Lectures:
Institute of Advanced Materials. ***Southeast University. Nanjing (China)***
July & October 2021



Virtual classes. "Superconductivity & Superconducting Materials"

22.-A Periodic Table with Countries of Discovery of the Elements



Collected by Jamie Callager@jamiegball.
Adapted and updated by M.Á.Alario-Franco (3-I-2017).

APPENDIX I

Some Scientific Divulgation Lectures.
Miguel Ángel Alario y Franco. YouTUBE

**La presión en la búsqueda de materiales*
Seminarios de Fronteras de la Ciencia de Materiales. Universidad Politécnica de Madrid
14 de noviembre de 2008.
https://www.youtube.com/watch?v=wZ-9iwt0tgg&t=144s

**¿Qué sabemos de la presión?: De Titán al interior de la Tierra.*
Curso Ciencia para Todos. Real Academia de Ciencias Exactas Físicas Naturales
25 de Junio de 2009.
https://www.youtube.com/watch?v=Cck7FpjWAag&t=237s

PbCrO3 y otros óxidos de cromo: estructura, microestructura y propiedades.
Sesión científica. Real Academia de Ciencias Exactas Físicas y Naturales
13 de Enero de 2010
https://www.youtube.com/watch?v=CDwpTAw9m5w&t=40s

*Ahorrando energía, materiales termoeléctricos....
Curso Ciencia para Todos. Real Academia de Ciencias Exactas Físicas Naturales
16 de Junio de 2011
https://www.youtube.com/watch?v=zf-tJIpj_fE&t=3165s

*De la Astroquímica al coche molecular o al fondo hay sitio
Conferencia magistral. Jornada de Cantabria. Campus Nobel dedicado a las Ciencias Básicas.14 jun 2012.
https://www.youtube.com/watch?v=59hsmpNF07Y&t=14s

*Una breve historia del diamante.
Semana de la Ciencia 2012. Real Academia de Ciencias Exactas Físicas y Naturales
1 de Noviembre de 2012
https://www.youtube.com/watch?v=DhMbH-4QsH0&t=8s

De la síntesis del amoníaco a la guerra química. Fritz Haber y la eterna paradoja: La ciencia del bien y del mal. Real Academia de Ciencias Exactas Físicas Naturales
8 de Mayo de 2014
https://www.youtube.com/watch?v=mwinvVuN0d4&t=2s

*El sueño de Copérnico y otros soñadores, viaje a los confines del sistema solar.
Curso Ciencia para Todos. Real Academia de Ciencias Exactas Físicas Naturales
16 Abril de 2015.
https://www.youtube.com/watch?v=jxAbtMRjDbc&t=1355s

El Agua en que vivimos.
Sesión científica conjunta de las Reales Academias del Instituto de España
22 de XI-2016
https://www.ranm.tv/index.php/video/901/

*Cuando las Perovskitas se pusieron a tomar el sol....
Curso Ciencia para Todos. Real Academia de Ciencias Exactas Físicas Naturales
18 de Julio de 2018
https://www.youtube.com/watch?v=MCLtsQj3v54&t=18s

El primer elemento químico español: una breve historia del platino.
https://www.fundacionareces.tv/ciencias-de-la-vida-y-de-la-materia/2019-ano-internacional-de-la-tabla-periodica-de-los-elemen/miguel-angel-alario-el-primer-elemento-quimico-espanol-un/
20 de junio de 2019

El sistema periódico de los elementos químicos.
Talk given by Miguel Angel Alario y Franco (Complutense University of Madrid) in the framework of the celebrations of the 80th Anniversary of the Faculty of Sciences of the UNAM-Mexico DF

3 de sep. de 2019. Auditorio Alberto Barajas Celis de la Facultad.
https://www.youtube.com/watch?v=GBOXn8HL4Ag&t=3040s

****Comunicación Científica Eficiente***
Laboratorio Complutense de Altas Presiones. 17 Ene 2018.
https://www.youtube.com/watch?v=Nw4hb9UYTs4&t=7s

**El sistema periódico ¿qué es y para qué sirve?*
Fundación Areces: clausura del Año Internacional de la Tabla Periódica.
17 de diciembre de 2019.
https://www.youtube.com/watch?v=Sq0uEeG8hEI&t=613s

**Acto Homenaje a Blas Cabrera y Enrique Moles*
Aula Magna de la Facultad de Ciencias Físicas de la Universidad Complutense de Madrid. 28 de febrero de 2020
https://www.youtube.com/watch?v=SrLPIGjeXGM

**Ciencia en 4 preguntas: El platino y sus aplicaciones.*
Ciencia en 4 preguntas Casa de las Ciencias-Ayuntamiento de Logroño.
22 de XI-2020
https://www.youtube.com/watch?v=0m96b7ZnP4M&t=810s

Appendix II.
A recent symposium.

Director & proceedings editor. MÁ Alario-Franco
****: a fruitful relationship on the way to superconductivity at room temperature.***

Errea Bozin Hemley Medina Silvera Morán Sáez-Puche Sánchez-Benítez
Vicent Goesten Jotzu Schuller Alario-Franco A Fuertes Attfield Teresa Puig G.Baonza

Full Symposium: 19 papers

on the web: **Fundación Areces** ***Madrid, 21-22 may 2018:***

Editor and author ***"Proceedings of the International Symposium: Superconductivity & Pressure: a fruitful relation"***. Areces Foundation, MADRID, November,2019.

TEXT

https://www.fundacionareces.es/fundacionareces/es/publicaciones/listado-de-publicaciones/proceedings-of-the-international-symposium-superconductivity-and-pressure-a-fruitful-relationship-on-the-road-to-room-temperature-superconductivity.html?tipo=2

19 Lectures on video:
https://www.fundacionareces.tv/ciencias-de-la-vida-y-de-la-materia/superconductividad-y-presion/

APENDIX III.-A **press interview, news and comments:**

An interview with the Spanish Press

El País

"Science is profitable"

INÉS SANTAEULALIA

Madrid - 05 ABR 2011 - 07:00 CEST

***"Miguel Ángel Alario y Franco,* Professor of Inorganic Chemistry receives today the Madrid Community, Miguel Catalán Research Award - He is 69 years old and works 15 hours a day. "*If I didn't, I'll get bored,"* he says.**

He arrives with a colorful structure in its hands. At first glance it looks like a Meccano, child's play, but in the eyes of Miguel Ángel it can explain the origin of an earthquake. With it he enters the Complutense High Pressure Laboratory, unique in Spain and one of the achievements of his long career. A career of more than 40 years as a professor, researcher, teacher, academic and, above all, a scientist. For his contribution to science, the Community of Madrid today awards him the Miguel Catalán Research Prize.

He started by throwing salt on the fire in his kitchen at home and mixing baking soda and lemon when he was eight years old. He didn't stop since. He is 69 years old and dedicates about 15 hours a day to his work. "Otherwise, I'd be bored," he says. Technically, he is the Spanish father of Solid-State chemistry, which could be described as the study of the properties of solids to see how they form and obtain new materials.

Some "drops"

"*Solids are like people; if they don't have defects, they are very boring"*

The teacher criticizes the teaching staff selection system

He started throwing salt on the kitchen fire when he was a child

He returned from England in 1973: "He who leaves must come back," he says.*"I was in London, then in Aberystwiyh, Wales, in the early 1970s when the university where I worked bought the world's first electron microscope in a Chemistry Laboratory"*. He peered into it and was fascinated to discover how "material defects" could be seen. And he never stopped investigating them again. *"Solids are full of flaws, they are like people, if they don't have flaws, they are very boring."*

It would be necessary to ask the students of the Chemistry faculties in Spain for their opinion on the matter, because Alario is, among many other things, responsible for this discipline reaching the study curricula to obtain the Chemistry degree¡

He came back from England in 1973 because he wanted to come back. That's what he's especially proud of. *"If I had gone to the US, maybe I wouldn't have done it, but whoever leaves must come back,"* he says convinced. Upon his return to Spain, he could have started working in a company instead of at the University and now, he says, he would be *"very well retired"*, like many of his colleagues. But that doesn't go with him either.

"*Unlike the common mortals, I work in what I like*".

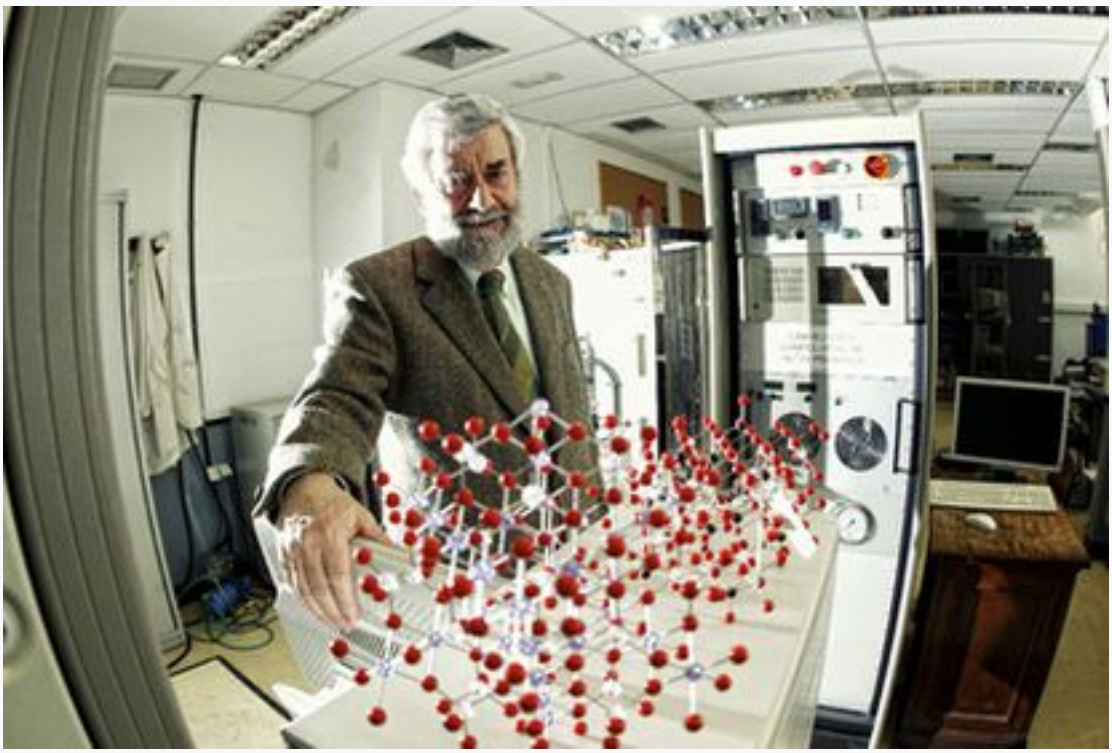
And what he likes is science, a field that he thinks very few people know about. *"Society has a good opinion of scientists, they look at you well if you say you're a scientist, but in reality, they don't know what you are,"* he says. He believes that the problem comes

from secondary education, where he thinks that science should be taught to those who do not want to be scientists. *"Those who want to be will learn it later, but everyone would have to get closer to see that it is not difficult and that, above all, it is profitable."*

In his case, in addition to his first steps at home with salt and fire, two teachers from his high school days were decisive in deciding to study Chemistry. *"I was not a student of the highest marks, but to compensate for not being the savviest I worked a lot,"* he explains. In 1976 he obtained the chair of Inorganic Chemistry of Complutense University, in which, among a few other things a good memory is needed, an issue that, the professor acknowledges, has a bad reputation, but which is essential to be a scientist.

As he has already seen everything from the classrooms, he feels that now the students arrive at the faculty a little "disoriented", with the only idea of getting a degree. Although he points out that there is always 10% of students who stand out *("mostly girls", he specifies*), he regrets that the rest are dedicated to taking notes *"without stopping and with a thousand colors marking, despite the fact that later they are useless".* But it doesn't just hit the students.

The professor also criticizes the teaching staff selection system. He believes that what one knows is no longer measured. "Here there are always those who tell you to put someone: *'Poor little thing, he is the son of a colleague of mine'. And, indeed¡, that should not be among the merits."*



Miguel Angel Alario Franco, in the **High-Pressure Synthesis Laboratory** that he founded, in Complutense University, where he is Professor of Inorganic Chemistry.
Photo ***Claudio Álvarez***

For this professor, the best merit is work, in which he hopes to continue at least until he is 75 years old. He recently added to his duties the presidency of the Royal

Academy of Exact, Physical and Natural Sciences, of Spain, which, he recalls, receives seven times less money than the Royal Academy of the Spanish Language.

If he were to be born again, he is clear that he would be a scientist, but he warns that he might do more things... Then he stops, shuts up for a second and discards the idea: *"Since it's not going to happen, I don't think you have to spend much time thinking about it "*. And time is what you don't have left.

He leaves his laboratory with the structure to explain earthquakes in his hands. The Academy awaits him.

The End… by now

With all those things, those wonderful things of this world, I have also enjoyed a lot throughout all these years... So far 80!

Actually, ¡there is time for (almost¡) everything!

Sure enough, over so many years, there were a number of unpleasant things, but those, of course, are not recounted. If one can… one forgets…

Miguel Ángel Alario-Franco