

Professor Jacques LIVAGE

Condensed Matter Chemistry

College de France

Paris - France

Personal

born: 26 October 1938, Neuilly sur Seine -France

married with two children

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Qualifications

. Master degree at the University of Paris (1960)

. Engineering degree at the Ecole Nationale Supérieure de Chimie de Paris (1960)

. PhD in chemistry - University of Paris (1966)

. Post-doc at the Clarendon Laboratory, Oxford (1968-70)

Designation

. Professor at the University Pierre and Marie Curie (1974-2000)

. Head of the laboratory "Inorganic Materials" UMR-CNRS 7574 (1978-2000)

. Member of the "Institut Universitaire de France" (1996-2000)

. Professor at the "Collège de France" since 2000

. Member of the French Academy of Sciences since 2001

. Member of the International Academy of Ceramics (2000)

. Member of the Indian Academy of Sciences (2003)

Invited professor :

1990. University of Trento - Italy

- 1991. University of Mexico - Mexico
- 1994. Institut Polytechnique Fédéral, Lausanne, Switzerland
- 1996. Tokyo Institute of Technology, Tokyo , Japan
- 2003. University of Buenos Aires, Argentina
- 2004. Indian Institute of Science, Bangalore, India
- 2006. University of Chile, Santiago, Chile
- 2007. Uppsala University, Sweden
- 2008. Tunis University, Tunisia
- 2009. Hong Kong University, China
- 2010. Academie Royale de Belgique

Organization of International Conferences

Chairman of the "7th Int. Workshop on Glasses and Ceramics from Gels" Paris (1993)

Co-chairman of :

- .. Glass Current Issue : NATO Advanced research Workshop, Canarias (1984)
- . Solid State Ionics : European Material Research Society, Strasbourg - France (1991)
- . 7th Int. Conference on Surface and Colloid Science : Compiègne- France (1991)
- . European Solid State Chemistry, Montpellier - France (1995)
- . Faraday Discussion on Gels, Paris - France (1995)

Member of the Scientific Advisory Committee

- . Glass Current Issue : NATO Summer School, Canarias - Spain (1984)
- . Transformation of Organometallics : NATO ARW, Agde- France (1986)
- . Eurogel 89 : Colmar- France (1989)
- . 33rd IUPAC Int. Symposium on Macromolecules : Montreal - Canada (1990)
- . Sol-Gel Optics I, SPIE : San Diego - USA (1990)
- . Sol-Gel Optics II, SPIE, San Diego - USA (1992)
- . Eurogel 92 : Colmar- France (1992)
- . Int. Symposium on Soft Chemistry Routes to New Materials, Nantes -France (1993)
- . Sol-Gel Optics III, SPIE, San Diego - USA (1994)
- . "Materials for Sensors" European Materials Research Society Meeting, France (1995)
- . 8th Int. Workshop on Glasses and Ceramics from Gels, Portugal (1995)
- Materials for Sensors, European Materials Research Society, France (1995)
- 8th Int. Workshop on Glasses and Ceramics from Gels, Portugal (1995)

- Vth European Conference on Solid State Chemistry, Montpellier (1995)
- 3rd International Conference on Smart Materials, Lyon (1996)
- 9th International Symposium on Intercalation Compounds, Bordeaux (1997)
- 9th Int. Workshop on Glasses, Hybrids and Nanocomposites from Gels, Sheffield-GB (1997)
- Science of Ceramic Processing, Santa Barbara - USA (1997)
- 4th FGIPS Meeting in Inorganic Chemistry, Corfou (1997)
- Cimtec'98- World Ceramic Congress, Florence - Italie (1998)
- Innovations in Materials Conference, Washington - USA (1998)
- Fifth Int. Conf on Frontiers of Polymers and Advanced Materials, Poland (1999)
- VIIth European Conference on Solid State Chemistry, Madrid (1999)
- 10th Int. Workshop on glasses, Ceramics, Hybrids and Nanocomposites from Gels - Japan (1999)
- Sol-Gel Optics V, SPIE, San Jose - USA (2000)
- 1st International Workshop on Nanomaterials, Saarbrücken - Allemagne (2000)
- International Symposium on Soft Solution Processing, Tokyo (2000)
- European Materials Research Society, Lausanne, (sept. 2003)
- 4th International Symposium on Electrochemical Processing of Tailored Materials, Kyoto, Japon (2005).
- Int. Conference on Bio-Nano-Information Fusion, Marina del Rey - USA (2005)
- 11th CIMTEC, Disclosing Materials at Nanoscale, Sicile - Italy (2006)
- Nanobio, Zurich (2010)

International Scientific Journals

Co-Editor of the "Journal of Sol-Gel Science and Technology"

Member of the Editorial Board.

- Chemistry of Materials
- Comptes Rendus de l'Académie des Sciences
- European Journal of Solid State and Inorganic Chemistry
- Journal de la Société Algérienne de Chimie
- Journal of Porous Material
- Journal of Materials Chemistry

- Heterogeneous Chemistry Reviews
- New Journal of Chemistry
- Solid State Science

Guest editor du Journal of Materials Chemistry

Special issue on new developments in bio-related materials

J. Aizenberg, J. Livage, S. Mann

Awards

- 1961- Award of Inorganic Chemistry, University of Paris
- 1980 - Award of the French Academy of Science
- 1989 - Gold medal of the Society for National Industry
- 1994 - Award of the "Comité du Rayonnement Français
- 2003 - Chevalier dans l'ordre de la Légion d'Honneur
- 2006 - Grande médaille de la Société Française de Métallurgie et Matériaux
- 2007 – International Sol-Gel Society life Achievement award

Scientific Publications.

. ≈ 400 publications in international scientific journals

. ≈ 140 invited and plenary lectures in international conferences

. ≈ 60 PhD

h index = 53

citations ≈ 12,000

citations per item ≈ 32

Sol-Gel Chemistry and "Chimie Douce"

Our main scientific contribution is in the field of the so-called sol-gel process. We have been dealing mainly with the chemistry and physical properties of transition metal oxide gels.

The sol-gel process is based on the polymerization of molecular precursors. Both the metal organic (alkoxides) and inorganic (aqueous solutions) routes have been

studied in our group. We have shown that the formation of solid phases can be controlled via the chemical modification of the molecular precursors by complexing organic or inorganic ligands.

The physical properties (electronic, ionic, optical, magnetic, electrochemical) of transition metal oxide gels (V_2O_5 , VO_2 , WO_3 ,...) have been extensively studied. These oxide gels could be promising candidates for micro-ionics (reversible cathode for lithium batteries, electrochromic devices, optical switches). Several patents have been taken describing the properties of "all gel" devices.

During the past decade, we focused our research on the biological applications of sol-gel chemistry. The mild conditions associated with the so-called 'sol-gel process' allow the synthesis of hybrid organic-inorganic nano-composites, in which both phases are mixed at the molecular level. These hybrids cover the whole range of materials from plastic polymers to brittle glasses. They are highly transparent and find applications for the realization of optical devices in which organic dyes are trapped within a silica glass. Sol-gel chemistry can even be optimized in order to trap fragile biomolecules opening new possibilities in the field of biotechnology. Enzymes and antibodies have been shown to retain their bioactivity in the silica matrix and can be used for making biosensors or bioreactors. Moreover, the catalytic activity of immobilized enzymes can be increased via the chemical control of the nanopores of the silica matrix. Even whole cells have been trapped within silica gels. Recent studies show that bacteria may remain viable for several weeks within silica gels. They keep their metabolic activity and could be used for the production of drugs. Hybrid gelatin-silica nanoparticles have been synthesized via the aerosol route. We have shown that they can cross the membrane of living cells and can be used as a nanovector for the delivery of drugs inside tumours.