

Constantin Vahlas

Director of Research 1st Class at the *Centre National de la Recherche Scientifique* (CNRS)

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Research Interests

Chemical vapor deposition, gas–solid interactions, surface chemistry, chemical thermodynamics. Metalorganic CVD of architected, (multi-)functional metallic and oxide films and particles on flat and complex surfaces and on powders for aerospace, pharmaceuticals, environmental monitoring applications.

Personal data

Born 28 February 1958 in Thessaloniki. Married with Isabelle Duffar, two daughters, Zoï 25 and Alexia 23 years old.

Education

- Habilitation (1992) and PhD in Metallurgy (1985, with honors, title: *Influence of tensioactive elements on the equilibrium and growth morphology of the interfaces between solid zinc and its liquid alloys*, PhD advisor Dr. N. Eustathopoulos), National Polytechnic Institute of Grenoble.
- Chemical Engineering Degree (1981), National Technical University of Athens.

Employment

- 2010 - CNRS 1st class director of research
Interuniversity Materials Research and Engineering Centre (CIRIMAT), CNRS, Toulouse
- 2002-2010 CNRS 2nd class director of research
Interuniversity Materials Research and Engineering Centre (CIRIMAT), CNRS, Toulouse
- 1990-2002 CNRS 1st class senior researcher.
Interuniversity Materials Research and Engineering Centre (CIRIMAT), CNRS, Toulouse (1994-)
Laboratory on Carbon Materials, CNRS, Pau (1991-1994)
Thermodynamics and Physical Metallurgy Laboratory, CNRS, Grenoble (-1991)
- 1985-1990 CNRS 2nd class senior researcher.
Thermodynamics and Physical Metallurgy Laboratory, CNRS, Grenoble.
- 1982-1985 PhD Fellow, Funded by the Centre National des Etudes Spatiales (CNES)

Sabbatical leaves

- 1994 Materials Science Department, University of Delaware, USA. 8 months. Visiting Professor with Prof. I.W. Hall. Worked on the experimental and thermodynamic investigation of the interfacial reactivity in Al-SiC metal matrix composites
- 1990 Metals and Ceramics Division, Oak Ridge National Laboratory, Tennessee, USA. 8 months. Research Fellow with Dr. T. M. Besmann. Worked on the thermochemical simulation of the MOCVD process for the fabrication of YBCO superconducting thin films.

Professional Activity

- Member, National Institute of Chemistry, CNRS (2018-)
Assisting the deputy director of the Institute in the management of the portfolio of ca. 5000 researchers and professors of the 200 research units nationwide affiliated with the Institute.
- Coordinator of the “SURF” research group in CIRIMAT (2000-2017).
SURF is composed of 5 CNRS scientists, 6 Professors, 2 technical staff, and (March 2017) of 2 post-doctoral fellows and 11 PhD students. The group has been ranked A+ by the Ministry of Education and Research; i.e. the highest score, corresponding to international excellence (top 5% worldwide) in the field of surface reactivity and protection, and especially in the MOCVD processes. Since May 2017 Dr. Thomas Duguet, CR CNRS, Rist Medalist of SF2M took the coordination of the group.
- Coordinator of the “Coatings” activity and CNRS representative at the European Center for the Development of New Metallic Alloys and Compounds (C-MAC) (2009-).

The European Integrated Center for the Development of New Metallic Alloys and Compounds - C-MAC - has been recently created as a long lasting structure, and as the successor organization of the European Network of Excellence Complex Metallic Alloys, NoE CMA. Breakthrough catalytic properties and high hardness combined with low friction properties have been put forward for quasicrystal and CMA which makes them interesting candidates for the replacement of noble metal catalysts in the chemical industry and for anti-adhesive of tribological coatings. Coating of materials with CMA has been thus the subject of intense research in the last ten years.

- French Vacuum Society representative for the International Union for Vacuum Science, Technique and Applications (IUVSTA) Surface Engineering Division (SED) (2011-2016).
IUVSTA is an international federation of thirty national vacuum organizations. It represents nearly 15,000 physicists, chemists, materials scientists, engineers and technologists who are active in basic and applied research, development, manufacturing, sales and education. Within IUVSTA, the SED monitors activities on multifunctionality of surfaces, interface design, multiscale modelling and engineered multilayers and nanostructured coatings.
- CNRS representative at the Materials Science and Engineering Expert Committee (MatSEEC) of the European Science Foundation (2009-2014).
MatSEEC is an independent science-based committee of over 20 experts active in materials science and its applications, materials engineering and technologies and related fields of science and research management. Committee members are nominated by their member institutions and they maintain strong links with their nominating organisations and their respective scientific communities. The aim of MatSEEC is to enhance the visibility and value of materials science and engineering in Europe, to help define new strategic goals, and evaluate options and perspectives covering all aspects of the field.
- Expert member for the High Council for Evaluation of Research and Higher Education (HCERES) (2011-).
HCERES is an independent administrative authority. Among others, it evaluates every five years all French higher education institutions and research bodies (departments and laboratories).
- Expert member (2014, 2016, 2017), and Chair (2015), “Materials Science and Engineering” Steering Committee of the Portuguese Foundation for Science and Technology (FCT).
FCT is the national funding agency for science, technology and innovation. FCT published two years on a raw an ERC-type individual call for proposals. The 2015 evaluation work of the MSE committee, composed of 17 European experts, concerned 311 applications. These were evaluated and ranked in an order of merit. FCT funded the first ca. 50 of them.
- Director, CNRS Materials Science and Engineering Interdisciplinary Program (2009-2012).
CNRS is organized in ten Institutes and about ten interdisciplinary programs. The annual budget of the MSE program was 400 k€ and this helped raising a turnover 1.5 M€/year through commonly funded projects with industry. Publishing of exploratory calls for proposals, contracts with industry, thematic workshops.
- Project Manager of the structuring of Materials Science and Engineering activities in the Midi-Pyrenees French Region, mandated by the Foundation “Science et Technologies pour l’Aéronautique et l’Espace” (STAE) (2011-2014).
The STAE Foundation is based on a network of 25 laboratories and 800 scientists. It aims at developing high level research in its field, whose results can be potentially transferred to the regional aeronautics and space industries, representing 100 institutions and 120,000 industry jobs.
- Member of the steering committee of the Materials and Processes (MATETPRO) annual call for proposals of the French « Agence Nationale de la Recherche » (ANR) (2011-2013).
ANR, the French national funding agency yearly published a call for proposals to support interdisciplinary projects by uniting scientific and industrial players with the aim to develop top performing materials and processes which respond to societal challenges and consider the sustainable development constraints. The call received ca. 100 projects per annum submitted by consortia composed of 5 to 6 industrial and academic partners. The success rate was 20 %, mean funding 850 k€ for 3 to 4 years.
- Expert member of the Work Group on Advanced materials & nanostructures, of the Technological Breakthroughs for Scientific Progress (TECHBREAK) activity of the European Space Agency (ESA) (2011-2012).
Foresight activity for ESA, addressing the delicate matter of technological breakthroughs for space originating in the non-space sector. A joint ESF-ESA “Forward Look” project called ‘TECHBREAK’ was initiated as a result. Its goals were to forecast the development of such breakthrough technologies to enable novel space missions in the 2030-2050 timeframe, and to identify related partnerships through synergies with non-space specialists. Identification of the current status of research for each domain, assessment of the development horizon for each technology and identification of some entry points, in the form of key European experts and institutions with knowledge of the domain.
- Project Manager of the implementation of a China-France Innovation Park in the domain of Advanced Materials, mandated by the French Ministry of Education and Research (2011).
France and China identified in 2011 advanced materials as one of the priorities for S&T cooperation. A scientific bilateral seminar deepened and detailed this scientific orientation and prepared an action plan. The French scientific delegation led by Vahlas identified four MSE domains and proposed implementation schemes of these domains.

- Director, CNRS group of research (GdR #3184) entitled «Deposition mechanisms from the gas phase on complex in shape surfaces (SurGeCo). 90 participants from 14 CNRS laboratories (2008-2011).
This CNRS supported academic activity aimed at (i) contributing to the reinforcement of French and European industries in the field of coatings, thin films and surface treatments of complex-in-shape parts, (ii) making progress in the insight and the control of the phenomena which connect gas phase processes with the microstructure and hence with the properties and the performance of such films and coatings, (iii) identifying common problems, investigated through complementary theoretical and experimental tools, determining underlying physical phenomena, and define the appropriate tools to elucidate them.
- Coordinator of a research action on surface treatments in the frame of CNRS Research Federation entitled «Fluids, Energy, Reactors, Materials and Transfers» (FERMAT) (2007-2010).
FERMAT has been established by CNRS and the University of Toulouse with the aim to initiate and to support interdisciplinary research in the large field of engineering sciences in Toulouse and the Midi-Pyrenees region.
- Director of the Integrated European Laboratory « Advanced Coatings Technologies », member of the « Complex Metallic Alloys » European Network of Excellence (CMA) (2005-2010).
CMA was funded in FP6 with the aim to contribute to a strengthening of the competitiveness of metallic materials for the benefit of European industries developing within four years into the European Center for the Development of New Metallic Alloys and Compounds (C-MAC) (see above).
- Director of the CNRS group of research (GdR #2256) entitled «Thin Film Materials: Processes, Properties, Simulations» (TEMPPS). 60 participants from 15 CNRS laboratories. (2003-2006).
TEMPPS aimed at coupling two aspects in process engineering: (a) targeted materials and corresponding gas phase reactors for their processing, (b) multiscale simulations, from the process to the crystallites.
- Member of numerous Scientific Councils of Institutes and Universities including participation in 15 selection committees for filling of research and teaching positions in CNRS and French and Greek Universities.
- Organizer or member of the scientific committee of 13 major national and international scientific conferences and schools.
- Organizer of 9 workshops; session moderator in 12 national & international conferences; referee in more than 20 international journals; expert for FWO Belgium, OPI Poland, ANCS-CNCS Romania, CEA France, FOM The Netherlands, Ministry of Education Greece, MBIE New Zealand, Paris-Sorbonne Cité, FCT Portugal.
- Guest editor of four special issues of the journals Chemical Vapor Deposition, Physica status solidi and Journal de Physique
- Member of the editorial board of the journal Ceramics International (-2014).
- Member of the Materials Research Society (MRS), of the Société Française de Génie des Procédés (SFGP), of the Group Français des Céramiques (GFC).
- In charge of ISO 9001 qualification of the research activities at CIRIMAT (succeeded, 2012).

Transfer & Valorization

- Coordinator of more than 40 research contracts and grants, summing up to more than 4 M€. 2016 Innovation Price of the National Polytechnic Institute of Toulouse.
- 6 patents (+2 under preparation).
- Ensured the transfer of two major findings to the industrial sector: (a) Process for the production of carbon nanotubes transferred to Arkema which, together with the Bayer process are the two major European industrial productions of CNTs, (b) Process for polymers metallization for space applications in the frame of the replacement of metallic by polymeric waveguides in telecommunications satellites with the SME Mecano ID.

Supervising, teaching, scientific production and strategic reporting

- 13 post-doctoral fellows (including 2 Marie-Curie grants), 23 PhD students, more than 35 MSc students.
- Participation in 44 PhD thesis and habilitation defense committees, president in 5 among them.
- Taught Thermochemistry and Phase Equilibria at the University of Pitesti (14 h/year since 2007), Brown University (14 h, 2009), University of Delaware (36 h, 1994), University of Grenoble (70 h, 1987).
- 200 articles published in journal and proceeding volumes (among them 5 reviews and 3 editorials), h-index 19, 1127 times cited without self-citations, 1 book, 4 book chapters, 40 invited communications in conferences and workshops, 51 seminars in universities, research centres and industry, more than 200 communications in conferences.
- 5 contributions to strategic reports among which 3 as main author or editor in chief.

*Example: **Materials Science and Engineering in Europe: Challenges and Opportunities. Science position paper.** C. Vahlas, editor, published by the European Science Foundation, Strasbourg, ISBN 978-2-36873-006-5, 2013, 23 pages. This report was compiled and edited by C. Vahlas, the working group leader, based on contributions by members of the working group. It is the result of an exercise of the Materials Science and Engineering Expert Committee (MatSEEC) of the European Science Foundation highlighting selected case studies to illustrate the state-of-the-art, to identify more general technological trends and targets for the next ten to twenty years,*

and finally, to derive strategic recommendations for MSE programmes for implementation by the European Commission, Member States and Funding Agencies.

Major contributions to early careers of excellent researchers

- Dr. Ioannis Aviziotis (PhD student): Post-doctoral fellow, University of Chemnitz, Germany.
- Dr. Pierre-Luc Etchepare (PhD student): R&D engineer, SGD Pharmacy, France.
- Dr. Thomas Duguet (Post doctoral fellow): CNRS researcher, CIRIMAT, France.
- Dr. Anna-Maria Lazar (Post doctoral fellow): Junior Scientific Officer, European Science Foundation, Strasbourg.
- Dr. Nathalie Prud'homme (Post doctoral fellow): Assistant Professor, Université d'Orsay, France.
- Dr. Christos Christoglou (Post doctoral fellow): Materials expert, Bayer Technology Services, Leverkusen, Germany.
- Dr. Asiya Turgambaeva (Post doctoral fellow): Senior Researcher, Nikolaev Institute of Inorganic Chemistry, Novosibirsk, Russia.
- Dr. Vladimir Krisyuk (Post doctoral fellow): Senior Researcher, Nikolaev Institute of Inorganic Chemistry, Novosibirsk, Russia.
- Dr. Fernando Juarez Lopez (PhD student): Senior Researcher, Center for Research and Innovation Technology, National Polytechnic Institute, Mexico.
- Dr. Maria Magdalena Sovar (PhD student): Project Director, Universitatea din Pitesti, Romania.
- Dr. Bassam Alameddine (MSc student): Associate Professor, Gulf University for Science & Technology (GUST), Kuwait.
- Dr. Pablo Ortiz Herrera (MSc student): Associate Professor, Universidad de los Andes, Colombia.
- Dr. Laurent Brissonneau (PhD student): R&D engineer, French Alternative Energies and Atomic Energy Commission, France
- Dr. Elisabeth Blanquet (PhD student) : CNRS Director of Research, Grenoble, France

Three highly cited publications

1. Nano Energetic Materials for MEMS: A Review. C. Rossi, K. Zhang, D. Estève, P. Alphonse, P. Tailhades, C. Vahlas, Journal of Micromechanical Systems, 2007, 16(4), 919-931. Cited 214 times (**highly cited paper** : received enough citations to place it in the top 1% of the academic field of Engineering based on a highly cited threshold for the field and publication year).
2. Parametric study for the growth of carbon nanotubes by catalytic chemical vapor deposition in a fluidized bed reactor. D. Venegoni, P. Serp, R. Feurer, Y. Kihn, C. Vahlas, P. Kalck. Carbon, 2002, 40(10), 1799-1807. Cited 113 times.
3. Principles and applications of CVD powder technology. C. Vahlas, B. Caussat, Ph. Serp, G. Angelopoulos, Mat. Sci. Eng. Reports, 2006, 53, 1-72. Cited 85 times.

Three recent publications

1. Metallization of Carbon Fiber Reinforced Polymers: Chemical Kinetics, Adhesion, and Properties. F. Addou, T.G. Duguet, P. Bosso, A. Zhang, E. Amin-Chalhoub, F. Fanelli, C. Vahlas. Surface and Coatings Technology, 2016, 308, 62-69.
2. Atomic Scale Structure of Amorphous Aluminum Oxyhydroxide, Oxide and Oxycarbide Films Probed by Very High Field ²⁷Al Nuclear Magnetic Resonance. L. Baggetto, V. Sarou-Kanian, P. Florian, A. N. Gleizes, D. Massiot, C. Vahlas. Phys. Chem. Chem. Phys., 2017, 19, 8101-8110.
3. Chemical Vapor Deposition of Al₁₃Fe₄ Highly Selective Catalytic Films for the Semi-Hydrogenation of Acetylene. I.G. Aviziotis, T. Duguet, K. Soussi, M. Heggen, M.-C. Lafont, F. Morfin, S. Mishra, S. Daniele, A.G. Boudouvis, C. Vahlas. Phys. Status Solidi A, in press DOI 10.1002/pssa.201700692.