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## Editorial

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### Federico Rosei

Énergie, Matériaux et Télécommunications,  
Institut National de la Recherche Scientifique,  
Université du Québec,  
1650 Boul. Lionel-Boulet,  
J3X 1S2 Varennes (QC) Canada  
Fax: +1-450-9298102 E-mail: rosei@emt.inrs.ca

**Biographical notes:** Federico Rosei received the Laurea Degree and the PhD Degree in Physics from the University of Rome 'La Sapienza' (Rome, Italy) in 1996 and 2001, respectively. He was a Postdoctoral Research Associate and Marie Curie Fellow at the Center for Atomic Scale Materials Physics, University of Aarhus, Denmark, from November 2000 to April 2002. He then joined the Faculty at INRS – Énergie, Matériaux et Télécommunications, University of Québec, Montréal, Canada, as an Assistant Professor in May 2002. Two years later, he was promoted to Associate Professor, with tenure. He holds the Canada Research Chair in Nanostructured Organic and Inorganic Materials. He has co-authored over 60 papers in international journals, given over 60 invited, keynote, and plenary lectures at international conferences and more than 90 seminars and colloquia at Universities, Government and Industrial Laboratories. His research interests focus on the properties of nanostructured materials, and how to control their size, shape, composition, stability, and positioning when grown on suitable substrates. He has extensive experience in fabricating, processing and characterising inorganic, organic, and biocompatible nanomaterials.

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This Special Issue of the *International Journal of Nanotechnology* is dedicated to research in Nanoscience and Nanotechnology performed in Canada. It follows previous special issues dedicated to 'Nano' research in Spain (2005), Ukraine (2006), Korea (2006), China (2007), Singapore (2007), Australia (2008), and France (2008). While the contents of this volume are by no means exhaustive, I believe I attained my original goal of providing an interesting snapshot of the Canadian Landscape in this emerging and exciting field of research [1].

I accepted enthusiastically Dr. Vayssieres' invitation to edit this special issue [2], as I wholeheartedly endorse his vision of providing snapshots of the state of the art of nanoscience/nanotechnology in individual countries and/or regions through the pages of this journal, consistently with its 'International' scope and dimension.

I am overall very pleased with the outcome and turnout that my Canadian colleagues and I have collectively achieved. This is the largest country-specific issue (quadruple volume for a total of 510 pages) to date, thanks to an overall overwhelming response from the Canadian 'nano' community. This effectively demonstrates Canada's commitment to research in this area and calls for more dedicated provincial and federal funding. I remark that until now, funding for 'nano' research in Canada has been

significantly fragmented with several programs running in parallel but no real concerted effort.

There has been one noteworthy federal initiative funded by the Natural Sciences and Engineering Research Council of Canada (NSERC, [www.nserc.ca](http://www.nserc.ca)), the 'Nano Innovation Platform' (<http://www.physics.mcgill.ca/NSERCnanoIP/e/>), for a total investment of 5 M\$ over five years which has helped to boost promising efforts across the country and has also funded the participation of students and post-doctoral fellows in local workshops and international conferences. In parallel, the Canadian Institutes for Health Research (CIHR, [www.cihr.ca](http://www.cihr.ca)) have funded roughly 5 M\$ team grant projects working in the area of nanomedicine, regenerative medicine and tissue engineering. In 2001, the National Research Council (NRC, [www.nrc.ca](http://www.nrc.ca)) has implemented a partnership with the Province of Alberta and the University of Alberta in Edmonton, each investing 60 M\$ to create the National Institute for Nanotechnology (NINT, [www.nint.ca](http://www.nint.ca)), presently the largest institution dedicated to nano research in Canada, with academic and NRC scientists holding cross appointments and working on joint projects. The other country wide effort worth mentioning is the Nanoelectronics and Nanophotonics program launched in 1999 by the Canadian Institute for Advanced Research (CIFAR, <http://www.cifar.ca/web/home.nsf/pages/nano>), which supports a focused group of scientists working specifically in electronics and photonics at the nanoscale (mostly Canada based although a few foreigners are also members). Besides these national initiatives there have been targeted programs funded at the Provincial level. Most notable is 'NanoQuebec' ([www.nanoquebec.ca](http://www.nanoquebec.ca)), a Provincial funding agency created by Valorisation Recherche Quebec (VRQ, [www.vrq.gouv.qc.ca](http://www.vrq.gouv.qc.ca)) which has supported 'nano' related infrastructure in Quebec as well as focused projects in all areas of nanoscience since 2001. The province of Ontario has been considering the possibility of a similar funding agency, but most likely with focus on applied research.

This quadruple volume describes a 'nano-research' landscape which goes well beyond the level of a simple snapshot, even though admittedly it is far from exhaustive. Regrettably several 'senior' scientists whom I invited to write reviews for this Special Issue either declined immediately or at a later stage when reminded that the deadline was imminent (for a total of five cancellations).

Although I personally do not like to adhere to a strict definition, I would broadly define 'Nano' research as the investigation of systems with at least one lateral dimension smaller than 100 nm, and exhibiting unusual or surprising properties because of the size reduction [3]. Many examples of such systems are to be found in the pages of this special issue, as summarised below.

This quadruple volume contains invited reviews from all over Canada, geographically distributed as follows: four from British Columbia, one from Saskatchewan, six from Ontario and six from Quebec. I remark in passing that this distribution does not necessarily reflect the proportion of 'nano'-scientists in the various regions of Canada; in fact the invitations I extended to scientists from NINT (Alberta) were turned down. Two papers (Lopinski and Veres) originate from the National Research Council (i.e., Government Laboratories) whereas the rest are from Academia. One paper (G. Botton) is actually not a review, as it describes the Electron Microscopy Facility at McMaster University in Hamilton (ON); although this is a national facility, it will also be able to serve international needs. The issue reports many Canadian strengths in nano-research, including Scanning Probe Microscopy studies of nanowires (A.B. McLean), semiconductor crystal growth (T. Tiedje), nano-magnetism (T. Veres),

organic/semiconductor interfaces (G.P. Lopinski), ceramic ferroelectric and multi-ferroic films and nanostructures (A. Pignolet), synchrotron radiation for nanoscale characterisation, (S. Kycia, T.K. Sham and S. Urquhart), luminescent nanocrystals (G.G. Ross, F. Vetrone), carbon nanotubes (Kruse), transport theory in nanostructures (H. Guo), the solidification of viscous melts (J. Bechhoefer), the study and application of 'nanoholes' in metals (A. Brolo and K. Kavanagh), nanostructured phospholipid membranes (A. Badia) and 2D supramolecular assemblies (J.V. Barth).

In the future [4], besides the continuation of the excellent work described in this special issue I also hope to see more 'nano' research in Canada devoted to applications in the thematic areas that represent humanity's great challenges for the 21st century [5], namely protecting and preserving the environment, improving our health, and most of all, identifying renewable and sustainable energy vectors. Our funding agencies should definitely take these challenges more seriously and should inject significant new funds to support research in these areas.

Finally, my special thanks go to all the referees who have graciously helped with timely and constructive criticism, improving the quality and clarity of the review papers published herein.

## References and Notes

- 1 For an overview of 'nano' funding in Canada see: Grütter, P. and Roseman, M. (2004) 'A study of Canadian academic nanoscience funding: review & recommendations' report prepared in the context of NSERC's Nano Innovation Platform. The report can be downloaded from the following link: [http://www.physics.mcgill.ca/NSERCnanoIP/e/Canada\\_Nano\\_Funding.pdf](http://www.physics.mcgill.ca/NSERCnanoIP/e/Canada_Nano_Funding.pdf)
- 2 Vayssieres, L. (2007) 'Editorial', *Int. J. Nanotechnol.*, Vol. 4, p.635.
- 3 Rosei, F. (2004) *J. Phys. Condens. Matter*, Vol. 16, p.S1373.
- 4 Levy, E. (2006) 'The future of materials research (Editorial)', *Adv. Mater*, Vol. 18, p.14.
- 5 Horley, G.A. (2006) 'The importance of being nano (Editorial)', *Small*, Vol. 2, p.3.