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Editorial

The contemporary science of materials and condensed-matter physics is changing in response to a new awareness of the relevance of concepts associated with *complexity*. Scientists who design and study new materials are confronted by an ever-increasing degree of complexity, both in the materials themselves and in their synthesis. Typically, modern advanced materials are partially non-crystalline, often multicomponent, and form out of equilibrium. Further, they have functional and structural properties that are active over several length-scales, and form via self-assembly. This emerging structural and functional complexity is *intrinsic* and *necessary* to many aspects of modern materials; features common also to generic complex systems. A central characteristic of the field is an awareness of the importance of multidisciplinary studies, at theoretical and experimental levels.

Some of the challenges and achievements of the growing community of physicists, chemists, chemical physicists/physical chemists and applied mathematicians studying this topic have been debated at the international conference "*New Materials and Complexity*" held in Canberra and Kioloa in November, 2003. This special issue contains contributions that emerged from that conference.

The theme of *Materials and Complexity* covers a range of topics. Some of those are represented in this volume, including:

- Multiscaled natural and synthetic materials: polymer films, superconductors, lyotropic liquid crystals, magnetic fluids, biomorphic composites, paper and pulp, granular materials, surface science;
- Biophysics: biomimetic materials, biological tissues, bones;
- DNA microarrays;
- Granular and Disordered Materials: structure of disordered packings, slow dynamics in granular matter and glasses;
- Complex systems theory: Non-Linear Dynamics and nano-scaled Surface Instabilities, Econophysics;
- Materials Characterization Techniques: State of the Art 2D and 3D Visualization animations, Micro-tomography and associated visualization, Atomic Force Microscopy and Surface Forces Apparatus measurements.

At first glance, it is difficult to detect a common scientific thread among areas as diverse as those listed above, spanning a diversity from econophysics to nanotechnology. Nevertheless, the remarkable unity of approach throughout the meeting and this volume—despite the multiplicity of specific topics—suggest that the embryonic theme of *Materials and Complexity* is indeed a meaningful one in scope and depth. To our knowledge, this is the first formal articulation of that theme.

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The polyglot community of scientists who assembled under the umbrella theme of *Materials and Complexity* naturally share common scientific foundations of statistical and condensed matter physics and advanced geometry and topology and their implications to many-body interactions and complex dynamics in condensed states, with particular interest in disordered and non-crystalline states.

Perhaps the strongest message to take home from this volume is the recognition of a *unified*, *identifiable community* bearing the hallmarks of modern science: *international* and *cross-disciplinary*.

The conference was attended by 58 participants, whose geographical diversity was impressive, including Australia, Italy, Germany, France, The United Kingdom, Sweden and Japan. We are proud to note the strong participation by junior researchers, including Ph.D. students and postdoctoral fellows from both Australia and Europe. Indeed, more than half of the participants were "junior" scientists, offering strong prospects for future long-term collaborations between the participants.

The meeting was permeated by an extraordinary sense of common interest and goodwill. This mood was surely enhanced by the fascinating diversity of topics, interwoven by common basic scientific concepts. There is no doubt that this goodwill will allow for further maturation of the *Materials and Complexity* community.

We are particularly grateful to the Italian Embassy, Canberra, for their strong moral and financial support, through their Scientific Attaché, Dr. Nicola Sassanelli. The ANU, through our Vice Chancellor, Prof. Ian Chubb, has also lent financial support to our meeting. We are also grateful to the Edith and Joy London foundation for financial support and for the beautiful Costal Campus in Kioloa that has greatly supported the successful outcome of this initiative. We thank Dr. Tim Wetherell for the logo, comprising a foam shell map and a Nautilus shell, used for this Materials and Complexity issue.

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