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FOREWORD

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Guest Editors

Vincent Fournée
Institut Jean Lamour
FR 2797, CNRS-INPL-UHP,
Ecole des Mines,
Parc de Saurupt,
Nancy 54042 cedex, France

Julian Ledieu
Institut Jean Lamour
FR 2797, CNRS-INPL-UHP,
Ecole des Mines,
Parc de Saurupt,
Nancy 54042 cedex, France

Patricia Thiel
Ames Laboratory and
Departments of Chemistry,
and Materials Science and
Engineering,
Iowa State University Ames,
IA 50011 USA

The term 'quasicrystals' stands for quasiperiodic crystals and by no means signifies that they are imperfect crystals. Quasicrystals represent a well-ordered state of matter just like periodic crystals, characterized by diffraction peaks as sharp as those for nearly perfect crystals such as silicon. But their long range order is aperiodic, and therefore they cannot be described by the periodic repetition of a small unit cell like normal crystals. Instead, quasiperiodic structures can be described as the three-dimensional restriction of a periodic structure embedded in a hyperspace of dimension N > 3. For example, a six-dimensional cubic lattice is used to generate the icosahedral quasilattice in three-dimensions. This is a general property of quasiperiodic functions, an archetype being the function $f(x) = \cos(x) + \cos(\sqrt{2}x)$, which is the sum of two periodic functions with incommensurate periods. This function can be regarded as the restriction along the line with irrational slope $y = \sqrt{2}x$ of the function F(x, y) = cos(x) + cos(y), which is periodic in the (x, y) plan.

Quasicrystalline materials were discovered 25 years ago by D Shechtman *et al* in rapidly solidified Al-Mn alloys. Many quasicrystals have been identified since then in binary and ternary systems. Most of them present non-crystallographic rotational symmetry like five-fold or ten-fold axes. Interest in this new class of materials was further driven by their potentially useful physical properties, either in the form of functional coatings or as reinforcement particle in composites. These practical aspects in turn raised fundamental questions about the nature of interfaces between periodic and quasiperiodic materials.

Interfaces are regions of high energy compared to the bulk, where atomic positions need to be adjusted on both sides of the interface to accommodate the two different lattices. How to describe interfaces and how nature minimizes the interface energy between a periodic and a quasiperiodic lattice is important in many ways. This special issue of *Journal of Physics: Condensed Matter* approaches various aspects of interfaces involving a quasicrystal and a crystalline counterpart. The first two articles [1, 2] discuss quasicrystal-crystal interfaces in bulk materials and their influence on materials strength. The next two articles [3, 4] introduce the general principles that govern such interfaces: coincidence of reciprocal lattice site and locking into registry of the two half-crystal atomic structures. Articles [5–7] deal with interfaces created by depositing overlayers on clean quasicrystalline surfaces prepared in ultra high vacuum (UHV). This type of study can be regarded as a situation where interfaces are formed and monitored step-by-step during the growth of the deposited film. Articles [8, 9] present similar studies where the formation of crystalline alloys as overlayers is observed on top of a quasicrystalline substrate, also in UHV environment. Articles [10, 11] deal with surface and interface energies and their role in the wetting of liquids on quasicrystalline substrates. Finally, [12] discusses the remarkable friction and adhesion properties of quasicrystal surfaces, involving a dynamical interface.

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