Editorial

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Biographical notes: Filipe Samuel Silva received his MSc in 1996, and PhD in 2002, both at Minho University, and is Professor at the University of Minho on the Mechanics of Materials area. He works at the Center for Mechanical and Materials Technologies – CT2M, at Minho University, and his research interests include processing technologies for FGMs-Functionally Graded Materials and fatigue and fracture of FGMs.

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José Filipe Vilela Vaz (F. Vaz) graduated in Physics and Chemistry teaching at the University of Minho, UM, Braga, Portugal in 1992, where he obtained also his PhD Degree in 2000. Since September 1992, he has been working at the Physics Department of UM, involved in research areas related with thin films and their application. Main research topics concern hard nanostructured thin films, with targeted applications varying from tools to machine parts, including polymers. From 2001, he is also developing new optical thin film systems, based on oxynitrides, oxycarbides, and their mixing. Materials with Surface Plasmon Resonance behaviour are also investigated.

In Functionally Graded Materials (FGMs), properties change gradually with position. The gradient in properties results from intentionally-induced variations in chemical composition and/or structure in selected regions of the material. Careful conception of the spatial gradation is of prime importance. Very often, the absence of a smooth gradient causes severe interfacial mismatches of physical, chemical and/or mechanical properties, resulting in a premature deterioration of components or component decrease of its performance limits.

Although in the last decade significant research efforts have been undertaken in order to understand and model the influence of the enormous number of parameters dictating the performance of FGMs, and to develop/improve the processing techniques for these materials, there are currently not many applications in which FGMs are used. In fact, only some examples of graded thin films and a few very recent developments in functionally graded bulk materials are known, which are clearly far beyond the potential importance of such materials. Also, an integrated approach is still lacking which would join the benefits of a functionally graded bulk material with a functionally graded coating along with a functionally graded interface. These joined approaches would allow a smooth transition between a certain bulk material and its coating, which would result in a better performing component. However, this joined approach implies a deep interdisciplinary understanding of basic mechanisms like: processing, phase equilibria, physical and mechanical characterisation, among others. In this respect, the modelling of some of these issues is not even started. A huge gap between the best coatings performances combined with the best characteristics for compatibility with the bulk material is still not filled.

Taking all this into account, this special issue intends to contribute to establish the state-of-the art regarding FGM materials, dissimilar bulk and coatings, and interface characteristics. For that, some International experts in the field contributed for this issue, and an International Workshop, First Portuguese Workshop on: 'Functionally Graded Materials: An Integrated Approach', that was held in Minho University was also promoted, and from which some of the most valuable contributions were also added.

The result is this special issue with a wide spread of matters, covering FGMs production and characterisation, modelling of the behaviour of such materials, and applications. The emphasis of this special issue is directed onto the interdisciplinarity of research and development in FGMs. This issue provides therefore a forum for scientists, researchers and application and design engineers working in the field of FGMs.