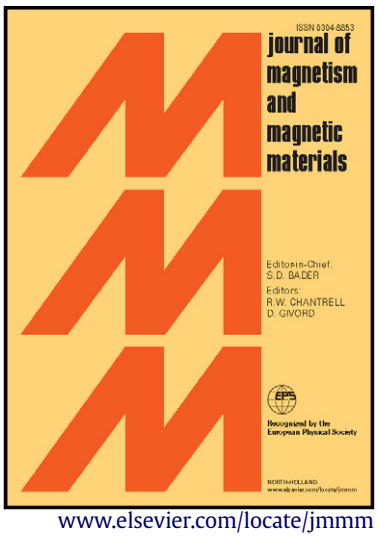

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Unexpected Magnetism in Nanomaterials

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Abstract

Conventional magnetic order in a material requires the partially filled d or f bands. The exchange interactions between the electrons in these partially filled bands give rise to a magnetic order. However, the discovery of unexpected magnetism observed in some nanomaterials, which have the d and f shells either completely empty or full, has challenged our understanding of magnetism in conventional materials. The magnetism in nanomaterials shows the effects of reduced dimensions, reduced coordination of atoms at the surface and some quantum effects which dominate at low dimensions. In this review paper we give a brief review and discuss the unexpected magnetism experimentally observed and/or theoretically predicted in nanomaterials of conventional magnetic and nonmagnetic bulk materials.

1. Introduction

The nanostructured materials are the critical building blocks for the fast emerging field of nanoscience and nanotechnology. The unique structural, physical, electronic and magnetic properties of nanostructured materials observed in experiments and/or predicted theoretically have attracted great interest in these materials in last couple of decades [1, 2, 3, 4, 5, 6]. The unique and unusual properties of nanostructured materials as compared to their corresponding bulk counterparts are mainly due to the emergence of quantum effects at nanoscale. The properties of nanostructured materials are strongly influenced by the finite size and microstructural details of both core and surface [6, 7]. There are three main approaches which are applied to create new nanomaterials: 1) top-down, 2) bottom-up, and 3) virtual approach. Top-down approach has been the traditional approach for miniaturization via lithographic tools. Bottom-up approach is the self-assembly