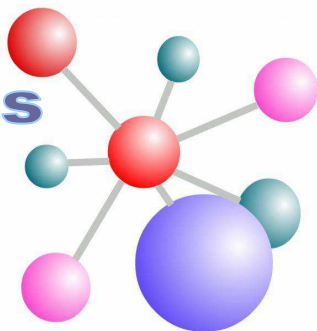


Inglês



Ciências Exatas e da Terra

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As questões de 01 a 05, cujas respostas deverão ser redigidas EM PORTUGUÊS, referem-se ao texto abaixo.

SYNTHESIS, CHARACTERIZATION, PROPERTIES, AND APPLICATIONS OF NANOSIZED FERROELECTRIC, FERROMAGNETIC, OR MULTIFERROIC MATERIALS.

Debasis Dhak, Seungbum Hong, Soma Das, and Prasanta Dhak

Recently, there has been an enormous increase in research activity in the field of ferroelectrics and ferromagnetics especially in multiferroic materials which possess both ferroelectric and ferromagnetic properties simultaneously. However, the ferroelectric, ferromagnetic, and multiferroic properties should be further improved from the utilitarian and commercial viewpoints.

Nanostructural materials are central to the evolution of future electronics and information technologies. Ferroelectrics and ferromagnetics have already been established as a dominant branch in electronics sector because of their diverse applications. The ongoing dimensional downscaling of materials to allow packing of increased numbers of components into integrated circuits provides the momentum for evolution of nanostructural devices. Nanoscaling of the above materials can result in a modification of their functionality. Furthermore, nanoscaling can be used to form high density arrays of nanodomain nanostructures, which is desirable for miniaturization of devices.

In the paper "Characterization of Multiferroic Domain Structures in Multiferroic Oxides," L. Liang et al. have reviewed the recent progress in the characterizations of multiferroic domain structures in multiferroic oxides. Due to the existence of two or three primary ferroic order parameters simultaneously in the same phase multiferroics and intricately coupling each other, new amazing multiferroic properties and/or phenomena are realized by combinations of distinct nanometer-scale charge-ordered domains, cloverleaf domain structures, and topological defects such as multiferroic vortex-antivortex pairs. Recent development of spherical aberration correction is revolutionizing the performance of HRTEM/STEM instruments, which allows one to achieve a spatial resolution better than 0.08 nm and an energy resolution better than 100MeV. Such breakthrough would bring us to see and thoroughly explore the multiferroic domain structures at subangstrom scale.

In the paper "Fabrication, Characterization, Properties, and Applications of Low Dimensional BiFeO₃ Nanostructures," H. Wu et al. also have reviewed the recent research progress of low-dimensional BFO nanostructures, including their fabrication, property, structural characterization, and applications. Perovskite-type BFO as one of the few known single-phase multiferroics possesses ferroelectricity and antiferromagnetism at room temperature. Its low-dimensional nanostructures are much attractive in the applications of multistate storage, magnetoelectric sensor, and spintronic devices.

In the paper "Growth of BiFeO₃ Microcylinders under a Hydrothermal Condition," L. J. Di et al. demonstrated the hydrothermal synthesis of cylinder-like BFO microcylinders, size of which is dependent on hydrothermal reaction time. Photocatalytical experimental results demonstrate that the BFO microcylinders exhibit an appreciable photocatalytic activity toward the degradation of "acid orange 7" under simulated sunlight irradiation. Magnetic hysteresis loop measurement reveals an antiferromagnetic behavior in the BiFeO₃ microcylinders at room temperature.

As the sizes of the microelectronics enter into nanoscale, there are still some problems that need to be solved in fabrication, characterization, and application of BiFeO₃ and other low-dimensional nanostructures. For instance, in BFO nanostructures there exists quantum size effect (ferroelectric and magnetoelectric), size effect, and surface/interface effect; all these effects must be considered together from experimental and theoretical researches, which are the fundamental to develop the new generation of revolutionary electronic nanodevices.

Although the BFO has good ferroelectricity, its weak ferromagnetism is highly required to be enhanced, which could be achieved in low-dimensional nanostructures. Therefore, deeper understanding of the fundamentals of the low-dimensional nanostructures with the development of advanced technology and exploring the coexistence of ferroelectricity and ferromagnetism with strong coupling between them will be the future direction of multiferroic nanomaterials researches.

Disponível em: <<http://www.hindawi.com/journals/jnm/2015/723145/>>. Acesso em 04 abr. 2015.

Questão 1

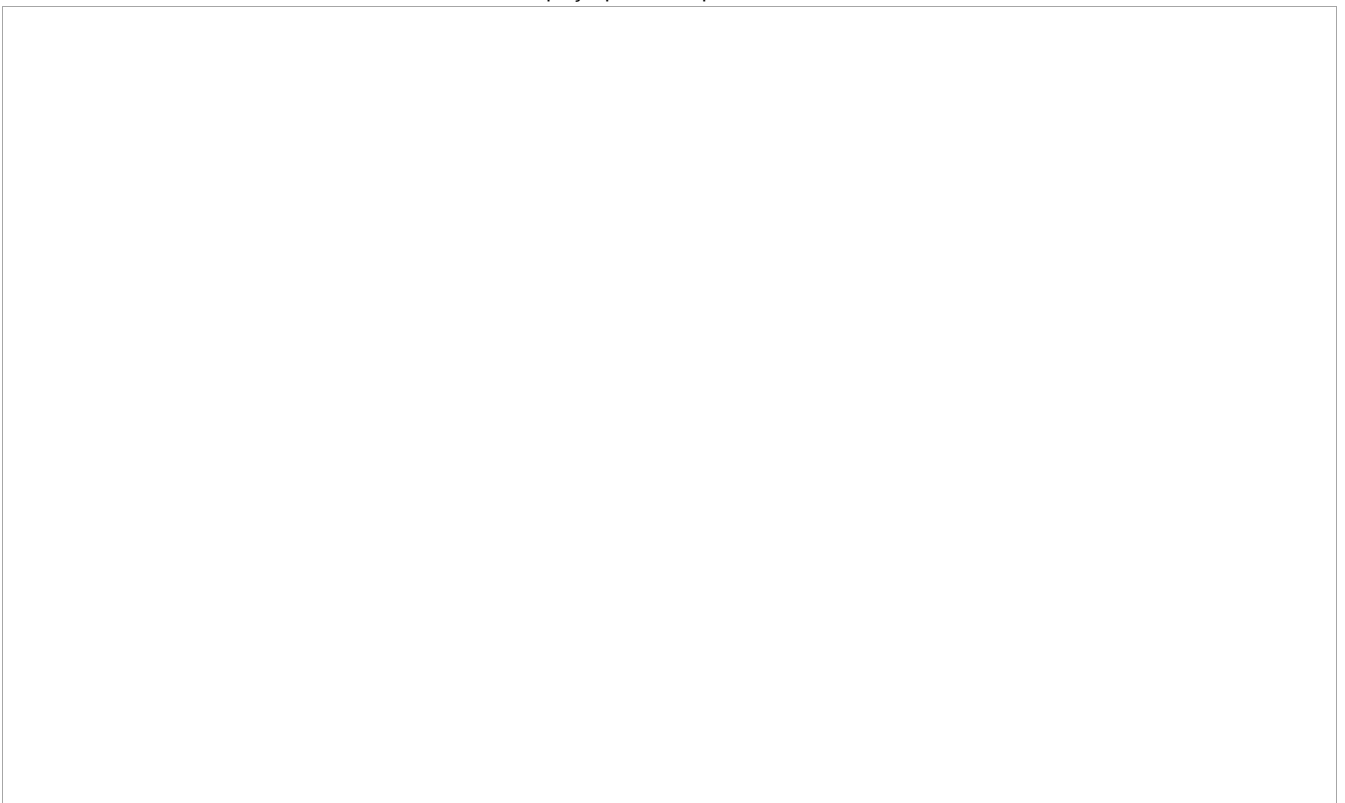
Por que materiais nanoestruturados são considerados centrais para a eletrônica e as tecnologias da informação?

Espaço para Resposta

**Questão 2**

A que se deve o surgimento de novas e fascinantes propriedades apresentadas pelos materiais multiferroicos?

Espaço para Resposta



Questão 3

Explique por que a correção da aberração esférica está revolucionando o desempenho dos instrumentos HRTEM/STEM e qual a sua aplicação imediata nesta área?

Espaço para Resposta

**Questão 4**

Quais os problemas apresentados, para o caso do BFO, quando a microeletrônica entra na nanoescala?

Espaço para Resposta

