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Nanostructured magnetic oxides (ferrites) from chimie douce nanoparticles consolidated by spark plasma sintering (SPS)

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Ferrite magnetic nanoparticles have raised a large technological interest by their potential applications, in many technology fields including biomedicine, electronics, and environment. In addition to the dramatic changes in properties between the "bulk" and the nanometric scale, magnetic materials exhibit variations in their magnetic properties due to the fact that many critical magnetic lengths (superpara-magnetism, single to polydomain structure, dipolar interactions) are found in the 1-50 nanometric range. For some applications such as electronic devices, a high density solid material is needed, instead of a nanoparticle powder. Classic sintering processes, however, lead to a rapid grain growth and hence to the loss of magnetic properties associated with the nanometric range. Spark plasma sintering, in contrast, allows the consolidation of nanoparticle powders at very low temperatures and extremely short processes which prevent grain growth. Physical properties originate by the nanometric scale can be preserved in sintered pieces with densities as high as 95% of the theoretical density of the compound. In this work, we present results obtained in the synthesis of magnetite and Ni-Zn ferrites nanoparticles (5-15 nm) obtained by the hydrolysis in polyol method. These NPs were subsequently consolidated by the spark plasma sintering (SPS) method at temperatures in the 500-750°C temperature range, and sintering times 10-15 min. A remarkable result is that the final grain size can be kept below 150 nm, thus preserving most of the physical properties originated by the nanometric scale. Recent results obtained on the magnetic properties of ferrites obtained by these methods will be discussed in this presentation.

Biography

Raul A Valenzuela Monjaras is a Professor of Materials Science and Engineering at the National University of Mexico. He has authored more than 160 basic research papers, several book chapters and the book "Magnetic Ceramics" (Cambridge University Press, 2005). His current interests are the synthesis and consolidation of nanostructured magnetic materials, their high-frequency magnetic properties and their applications.

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