DEPOSITION AND CHARACTERIZATION OF FUNCTIONAL NANOPARTICLES OF LEAD-ZIRCONIA TITANATE (PZT) IN MATRICES OF MESOPOROUS SILICA OF MCM-48-TYPE STRUCTURE

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For the first time MCM-48 was used as the matrix for size-confined lead zirconate-titanate PbZr\(_x\)Ti\(_{1-x}\)O\(_3\) (PZT), where x is varied from 0 to 1. PZT gel prepared using a co-precipitation method was introduced into the channels of MCM-48 by dip wet impregnation technique. Calcination in air led to the formation of PZT in the pores of MCM-48. All the synthesized composites were characterized by means of XRD, TEM, BET and AAS. No Bragg-peak due to the PZT was observed in the wide angle XRD pattern, indicating the particle size of the encapsulated PZT is below 2 nm. TEM and \(N_2\) adsorption measurements further confirm the deposition of nanosized PZT particles inside the pores of the mesoporous matrix without destroying their integrity. AAS analyses reveal both the metal composition and the loading of ca. 11 to 16 wt% of the encapsulated PZT.

1. Introduction

In recent years the preparation of nanocrystalline lead zirconate-titanate (PZT) powders has attracted much attention due to their unique piezoelectric and ferroelectric properties [1]. PZT-based piezoelectric materials exhibit excellent electromechanical properties and are widely used as ultrasonic resonators, ceramic filters, high-power transducers, actuators, and so on [2]. Because of fundamental and technological importance of PZT, few chemical methods have been developed to lower the reaction temperature and get nanocrystalline PZT materials of chemical homogeneity, which cannot be obtained by conventional solid-state method [3-5]. To obtain the materials with desired electrical properties, a perovskite structure is required. One of the necessary conditions for

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