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Effect of doping CaO in $NiMn_2O_4$-$LaMnO_3$ composite NTC thermistors on microstructure and electrical properties

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The negative temperature coefficient (NTC) thermistors (TRs) based on mixed transition-metal and rare earth metal manganite electroceramics have been widely used for temperature measurement, control, compensation and suppression of inrush current, due to their high stability and low cost. In general, NTC materials are spinel oxides, a high B value generally couples with high electrical resistivity and vice versa. However, some applications such as suppressing the inrush current require NTC materials with a low electrical resistivity (≤10 Ω•m) while possessing a large B (≥2600 K) and sufficient stability. General ways to design a new material are composite and doping. In principle, the material with low electrical resistivity and high B may be obtained through introducing a second phase with low electrical resistivity into a spinel oxide of high B. What's more, the composite can make full use of favorable condition and promote complementarity in each component due to the adjustability of its multiplicity and binding form, and the outstanding and attractive properties that the single component couldn't achieve may be obtained by complex method. Therefore, we propose and verify that the resistivity and B value can be adjusted to desired values by introducing $LaMnO_3$ doped by CaO into the spinel oxide $NiMn_2O_4$.

The composite ceramics $(NiMn_2O_4)_{0.50}(La_{1-x}Ca_xMnO_3)_{0.50}$ ($0≤x≤0.3$) consisting of spinel-structured $NiMn_2O_4$ and perovskite-structured CaO-doped $LaMnO_3$ were prepared by classical solid state reaction. The obtained $\rho 25$, $B_{25/50}$ constants of the composite samples doped by CaO are in the range 0.234-8.61 Ω•m and 2600-2962 K, respectively, and the resistivity drift after aging at 125 °C for 500 h in air is relatively small (0.34% when x=0.3). The electrical conduction of the composite ceramics can be elaborated by the ions migration mechanism. Such ceramics could be used as potential candidates for NTC thermistors in suppression of inrush current.

Biography

Huimin Zhang has completed the Ph.D. at the age of 23 years from Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences. She has been to University of Washington as a visiting scholar in 2011. When she came back to China, she has been working for ceramic material preparation and device fabrication as Associate Professor. Up to now, she has published more than 10 papers and 5 patents.

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Magnetic silicon quantum dots: A recyclable photocatalyst for melamine degradation

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A novel method for the preparation of heterostructure nanocomposites of magnetic silicon quantum dots (Fe_3O_4/SiQDs) has been reported. This method is simple, inexpensive, green, and efficient compared with the former routes utilized to synthesize the similar nanostructures. Hereby, synthesis of magnetic nanoparticles-semiconductor nanocomposites is interesting, as these nanostructures may be served as effective recoverable photocatalysts in various photodegradation reactions. Fe_3O_4/SiQDs nanocomposites exhibited fluorescence, displayed excellent magnetic properties at room temperature, and have high photocatalytic melamine degradation ability. Due to their easy recovery by magnetic separation, photocatalytic activity only decreased slightly after 15 cycles of usage.

Biography

Iram Mahmood has completed her Ph.D. in Chemical Engineering from Institute of Process Engineering, Chinese Academy of Science (IPE-CAS), Beijing, China. With topic entitled "Design synthesis and applications of multifunctional nanomaterials", she was also awarded Ph.D. scholarship from NUST to continue higher studies at CAS. She has also been a research fellow at Centre of Super Diamonds and Advanced Films (COSDAF), City University of Hong Kong for one year. Earlier, she was awarded post graduate (PG) fellowship from TWAS-CAS (Italy-china) for research in the field of Process Engineering. Apart from experimental skills, she has published more than 20 research papers.

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