无机材料学报 2007 22 (4): 715-719 ISSN: 1000-324X CN: 31-1363/TQ

$La_{0.67}Ca_{0.33}MnO_3$/MgO复合体系中的电输运和磁电阻效应

任光明, 袁松柳, 缪菊红, 余功奇, 肖 循, 尹诗岩

华中科技大学物理系, 武汉 430074

收稿日期 2006-7-19 修回日期 2006-9-7 网络版发布日期 2007-7-5 接受日期

摘要 用化学方法制备了(1-x)$La_{0.67}Ca_{0.33}MnO_3$(LCMO)/xMgO颗粒复合体系. 通过选择不同的前期预烧温度(T_s1)控制LCMO原粉的颗粒大小. 研究表明, MgO的含量和LCMO的前期预烧温度对复合体系的电输运和磁电阻效应有显著的影响. 对T_s1=1100℃的样品, 仅在纯LCMO和x=1mol%的复合样品中可以观察到绝缘体金属转变. 而对T_s1=900℃的样品, 在x=7mol%的复合样品中还可以观察到绝缘体金属转变, 其最大低场磁电阻(H=0.3T)从纯LCMO的5%增加到27%. SEM形貌分析表明MgO含量增加或LCMO前期预烧温度升高都使复合体系中LCMO颗粒之间的联结性减弱. 运用自旋极化隧穿机理, 对实验结果进行了讨论.

关键词 颗粒边界效应 低场磁电阻 自旋极化隧穿 弱联结

分类号 TM271

Electrical Transport and Magnetoresistance in $La_{0.67}Ca_{0.33}MnO_3$/MgO Composites

REN Guang-Ming, YUAN Song-Liu, MIAO Ju-Hong, YU Gong-Qi, XIAO Xun, YIN Shi-Yan

Department of Physics, Huazhong University of Science and Technology, Wuhan 430074, China

Abstract A $La_{0.67}Ca_{0.33}MnO_3$(LCMO)/MgO granular composite system was fabricated by a chemical route. The grain size of the parent LCMO powders can be altered by controlling the initial sintering temperature. It shows that electrical transport and magetoresistive properties of the composite system strongly depend on the MgO content and initial sintering temperatures. For the samples with T_s1=1100℃, the insulator-metal transition can be observed only in pure LCMO and the x=1mol% composite. However, For the samples with T_s1=900℃, the insulator-metal transition can still be observed in the x=7mol% composite in which the maximal low field magnetoresistance (H=0.3T) is enhanced from 5% in pure LCMO to 27%. SEM analysis shows that linking between LCMO grains is weakened with increasing MgO content or elevating the initial sintering temperature. The experimental results were discussed in terms of the spin polarized tunneling mechanism.

Key words grain boundary effect low field magnetoresistance spin polarized tunneling weak-link

DOI:

通讯作者 袁松柳 yuansl@hust.edu.cn