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Na^+掺杂对钙钛矿$La_{0.7}Sr_{0.3-x}Na_xMnO_3$的结构及磁熵变的影响

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摘 要： 采用溶胶-凝胶法制备了钙钛矿$La_{0.7}Sr_{0.3-x}Na_xMnO_3$($0.05\leqslant x\leqslant 0.3$)系列样品。结果表明：由于$Na^+$离子半径(0.102 nm)小于$Sr^{2+}$离子半径(0.127 nm)，导致$La_{0.7}Sr_{0.3-x}Na_xMnO_3$($0.05\leqslant x\leqslant 0.3$)样品的结构随着$Na^+$离子掺杂量的增加由正交向单斜转变。样品的晶胞参数$a$随$x$的增大而增大，而$c$随$x$的增大而减小，$c/a$随$x$的增加而减小；样品的形貌呈现不规则的颗粒状，中间还夹杂着棒状物；随着Mn^{4+}与Mn^{3+}摩尔比的增加，A位的平均离子半径减小及A位离子失配效应减小的共同影响下，当$x\leqslant 0.2$时，居里温度随着Na^+离子掺杂量的增加而增加；当$x>0.2$时，居里温度随着Na^+离子掺杂量的增加而下降；由于Na^+离子掺杂引起的容差因子的减小，晶格收缩、铁磁耦合变小，导致居里温度附近的最大磁熵变随x增加而减小。

关键字： 钙钛矿；双交换；居里温度；最大磁熵变

Effect of Na doping on structure and magnetic entropy of perovskite $La_{0.7}Sr_{0.3-x}Na_xMnO_3$ doped with Na^+

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Abstract: $La_{0.7}Sr_{0.3-x}Na_xMnO_3$($0.05\leq x\leq 0.3$) powders were prepared by sol-gel technique. A structure transition from orthorhombic to monoclinic was observed with increasing x values in $La_{0.7}Sr_{0.3-x}Na_xMnO_3$. The crystal parameter a increases and c decreases with increasing x values. The c/a ratio becomes smaller with increasing addition of Na^+. The morphologies of $La_{0.7}Sr_{0.3-x}Na_xMnO_3$ sample are irregular particles and part of sticks. This can be induced to three aspects with increasing molar ratio of Mn^{4+} to Mn^{3+}, decreasing average ionic radius and lessening ionic mismatch effect. The Curie temperature T_C and magnetization of $La_{0.7}Sr_{0.3-x}Na_xMnO_3$ powders increase with increasing x in the rang of $x\leq 0.2$. However, the maximal magnetic entropy around T_C decreases with increasing x values, which can be induced to the tolerance factor decrease, crystal lattice shrink and ferromagnetic coupling decrease.

Key words: perovskite; double exchange; Curie temperature; maximal magnetic entropy

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