Crystal structure and magnetic properties of the nanoparticle $(La_{0.7}Sr_{0.3})_{0.9}Mn_{1.1}O_3$ and $La_{0.7}Sr_{0.3}MnO_3$ manganites.

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We report on the X-ray powder diffraction and magnetic measurements of the nanosize $(La_{0.7}Sr_{0.3})_{0.9}Mn_{1.1}O_3$ and $La_{0.7}Sr_{0.3}MnO_3$ manganites. The nanosize manganites were synthesized with a sol-gel method at different (800, 900 and 950 ^{0}C) and (600, 700, 800 and 1000 ^{0}C) temperatures, respectively. Their crystal structure was determined to be perowskite - like with a rhombohedral distortion (the space group R3c). The average size of synthesized nanoparticles (from 17 to 88 nm) for both manganites was estimated by the low temperature adsorption of argon and X-ray diffraction methods. The temperature dependences of ZFC and FC magnetization show that for all the samples studied a ferromagnetic – like behavior is observed. Both magnetization and the Curie temperature decrease with reducing particle size. The decrease of magnetization is due to the disordered surface shell of particles. The relative surface contribution, or the surface/volume of the grains ratio, increases due to the larger surface area of the small particles, and therefore their spontaneous magnetization is diminished. The magnetic entropy was shown to increase with increasing applied magnetic field and to be smaller for the small particles. The total magnetocaloric effect (MCE) reduces as the particle size diminishes, since the contribution of the outer shell having the disordered magnetic state to MCE will decrease.