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Mechanical milling effect on the structural and magnetic properties of sintered $\text{La}_{0.67}\text{Sr}_{0.33}\text{MnO}_3$

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Structural and magnetic properties of sintered and milled $\text{La}_{0.67}\text{Sr}_{0.33}\text{MnO}_3$ was investigated in the temperature range of 300-2 K. The refined X-ray diffraction (XRD) data show that all samples are single phase and crystallize in rhombohedral symmetry with $R\bar{3}C$ space group. The as-prepared samples (SK) were milled for 1, 3, 6 and 12 hours (SKM1, SKM3, SKM6 and SKM12). The crystallite size decreased from 46-11 nm as a function of milling except for SKM12 which increased slightly to 12 nm due to thermal effect of prolonged milling. The cell volume increased from 349-352 \AA^3 except for SKM12 which dropped to 349 \AA^3 due to peak shift to a higher 2θ as a result of strain. High-resolution transmission electron microscopy HRTEM and high-resolution scanning electron microscopy HRSEM of the samples show a variation in the morphology. The saturation magnetisation M_s was estimated from the hysteresis loops using the law of approach to saturation magnetisation. M_s for all samples increases as temperature decreases. At the maximum and minimum measuring temperature of 300 K and 2 K respectively, the M_s for SK, SKM1, SKM3, SKM6 SKM12, are 52, 45, 22, 13, 7 emu/g and 80, 79, 64, 53, 40 emu/g respectively. The drop in M_s has been explored based on a core-shell model. The coercivity at 2 K showed a significant increase from 0.17 kOe for SK to 0.87 kOe for SKM12. The hysteresis loops of all samples at 2 K exhibit a trend from superparamagnetism to ferromagnetism, while at 300 K, a trend of superparamagnetism to paramagnetism is observed.

Summary

Mechanical milling, superparamagnetism, paramagnetism, ferromagnetism

Apply to be considered for a student award (Yes / No)?

Yes

Level for award (Hons, MSc, PhD, N/A)?

PhD

Main supervisor (name and email) and his / her institution

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**Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?**

Yes

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