

# Effect of Gd substitution for La on the structure and magnetic properties of the $\text{La}_{1-x-y}\text{Sr}_x\text{Gd}_y\text{MnO}_3$ nanoparticle

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Magnetic nanocrystalline of  $\text{La}_{1-x-y}\text{Sr}_x\text{Gd}_y\text{MnO}_3$  (LSGM) with  $y = 0, 0.05, 0.10, 0.15$  and  $0.20$  are synthesized by a thermal-hydro decomposition method at  $800\text{ }^\circ\text{C}$  in air for 6 h. All samples are characterized by TG-DTA, XRD, SEM and VSM. The XRD result shows that all the prepared samples have perovskite structure with rhombohedral phase. The crystalline sizes are in the range of  $18.1 - 21.1\text{ nm}$ , which increases with decreasing Gd content ( $y$  value). The SEM images of prepared samples show the spherical nanoparticles shape with agglomeration of particles. The VSM result shows soft-ferromagnetic behavior for all samples with the magnetization ( $M$ ) value of  $9.3 - 34.6\text{ emu/g}$ . The  $M$  value decreases with increasing Gd content. The substitution for La by Gd with a smaller ionic size than La usually leads to a decreases of lattice parameters and decreases of crystalline sizes. The decrease of magnetization value with increasing Gd concentration associated distortion structure with high mismatch factor ( $\sigma_2$ ).

## Summary

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