

# SYNTHESIS OF LaMnO<sub>3</sub> NANOPARTICLES AND INVESTIGATION OF THEIR STRUCTURAL, MORPHOLOGICAL AND MAGNETIC PROPERTIES

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Main objective - to synthesize LaMnO<sub>3</sub> nanoparticles via sol-gel polyacrylamide route, find out the phase purity, particle size and morphology dependence on reaction parameters and to analyze the magnetic properties of the obtained samples.

Lanthanum manganite (LaMnO<sub>3</sub>) is a perovskite type material, which can be described with the general formula of ABX<sub>3</sub> (A and B cations, X - oxygen or halogens). The ideal perovskite structure is cubic, although it can occupy almost any structures due to defects in the crystal structure (orthorhombic, tetragonal, hexagonal. . .). LaMnO<sub>3</sub> that was obtained via this method has the rhombohedral R-3c structure.

This compound has various useful properties, such as colossal magnetoresistance, chemical stability in various mediums and in a vast temperature range, electrical conductivity, antiferromagnetic properties in bulk and superparamagnetic properties as nanoparticles [1], [2]. It can also be utilized for photocatalytic reactions, such as the degradation of various dyes in contaminated wastewater [3].

The sol-gel polyacrylamide synthesis route was used for the preparation of LaMnO<sub>3</sub>. Although this material can be made via various methods, but most often they require complicated instruments, costly reagents and the final product has a large particle size distribution. The polyacrylamide route is optimal for the synthesis of nanoparticles, due to it being both cost and time effective, it does not produce any toxic byproducts and it provides the ability to reliably obtain nano-sized particles due to the creation of a polymeric scaffold with a large surface area [4].

During our research, the purity and structure of the samples was ascertained via X-ray diffraction, FT-IR and Raman spectroscopies, the size and morphology were investigated by utilizing Scanning Electron Microscopy (SEM) and Brunauer-Emmett-Teller (BET) analysis. The magnetic susceptibility studies were performed in order to evaluate the magnetic behavior.

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[1] M.N. Iliev et al, Raman monitoring of the dynamical Jahn-Teller distortions in rhombohedral antiferromagnetic LaMnO<sub>3</sub> and ferromagnetic magnetoresistive La<sub>0.98</sub>Mn<sub>0.96</sub>O<sub>3</sub>, 2000, 341, 2257-2258.

[2] S.A. Hosseini et al, Selective catalytic reduction of NO<sub>x</sub> by CO over LaMnO<sub>3</sub> nano perovskites prepared by microwave and ultrasound assisted sol-gel method, 2018, 85, 3, 647-656

[3] P. Stirloaga et al, Investigation of Catalytic and Photocatalytic Degradation of Methyl Orange Using Doped LaMnO<sub>3</sub> Compounds, Processes 2022, 10(12), 2688

[4] Shi-Fa Wang et al, Magnetic Nanocomposites Through Polyacrylamide Gel Route, Nanoscience and Nanotechnology Letters 6(9), 758-771