Synthesis and primary characterization of MgO nanoparticles doped with transition metals

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Abstract: Currently, it is well known that nanoparticles and nanostructures possess physical properties much different from the bulkcounterparts that brand them desirable in materials science and biology.In the family of transition metal plus MgO nanostructures, the Fe/MgO(100) interface has attracted much scientific attention as it is considered to be a fundamental building block of spintronic devices [1,2]. In this system, the interaction of nuclei with non-zero spin atom with electron spin creates exciting physical phenomena. This leads to numerous crucial properties such as magnetization controlled by an electric field, giant tunnel magnetoresistance etc. [1, 2]. It will be much interesting to see whether the transition metal doping in MgO can lead to such exciting physical phenomena. Further, in order to design the multifunctional devices with nanoscale dimensions, it is essential to tune physical properties and induce magnetism in nanostructures of wide band gap oxide nanomaterials. Doping with transition metals has been observed to tune the optoelectronic and magnetic properties of nano MgO [3, 4].

Present work focuses on the synthesis of Fe- and Mn-doped MgO nanoparticles via the sol-gel auto combustion method. This method is known to be cheap and eco-friendly. Hydrated metal nitrates $Mg(NO_3)_2{:}6H_2O$, $Mn(NO_3){:}4H_2O$ and $Fe(NO_3)_3{:}9H_2O$ were used as precursors in the synthesis of nanoparticles. Figure 1 presents the steps that we have followed for the sol-gel process during the synthesis of Fe and Mn-doped MgO nanoparticles. The process is presented in the flow chart. The samples prepared were characterized by X-Ray Diffraction (XRD). The Rietveld refinement of X-ray diffraction confirms the single-phase formation and nano-size of particles with the average crystallite size below 50 nm [5]. The synthesis procedure, primary results and analysis will be presented in the conference.

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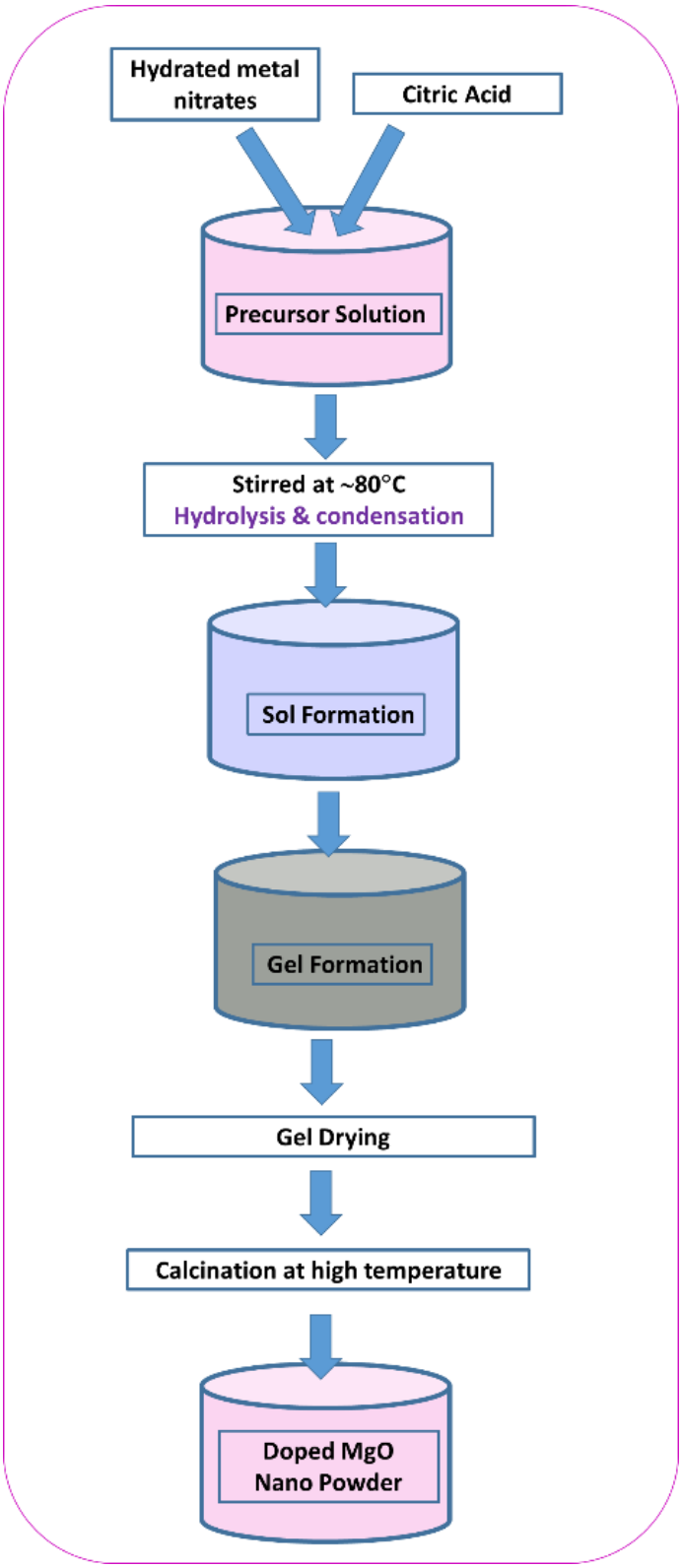

Steps of the sol-gel process

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