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## 57-Fe Mössbauer spectroscopy on Fe-Mg-O nanocomposite particles grown by a novel chemical vapor synthesis method

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**Statement of the Problem:** The admixture of 3d transition metals to particles and ceramic structures of non-reducible metal oxides has given rise to a variety of functionalities used in industrial applications. However, it is not easy to control the impurity localization and the nanomaterials functional properties.

**Methodology & Theoretical Orientation:** Powders of Fe-Mg-O nanocomposite particles have been grown using a novel chemical vapor synthesis approach which involves metalorganic precursor decomposition inside the combustion flame. After annealing in controlled gas atmosphere composition distribution functions, structure and phase stability of the obtained magnesiowüstite nanoparticles were measured with a combination of methods.

**Findings:** 57-Mössbauer spectroscopy measurements revealed that - depending on Fe loading and annealing temperature - either metastable and superparamagnetic solid solutions of Fe III ions in periclase MgO or phase separated mixtures of MgO and antiferromagnetic magnesioferrite MgFe<sub>2</sub>O<sub>4</sub> nanoparticles can be obtained.

**Conclusion & Significance:** The combination of the present hybrid combustion technique with annealing protocols emphasizes the great potential of vapor phase grown non-equilibrium solids. Applying this method, phase separation, disproportionation and the appearance of magnetic properties can be tuned intentionally. Different from their bulk counterpart, MgFe<sub>2</sub>O<sub>4</sub> nanoparticles with identical composition and structure are superparamagnetic and are promising material components for magnetic resonance imaging (MRI) as high density information storage materials or for magneto-caloric refrigeration.

### Biography

Werner Lottermoser is a Solid State Physicist. He has completed his thesis work on neutron diffraction and magnetism of special silicates at CNRS, CENG and ILL Grenoble, France, and University of Frankfurt, Germany. He obtained qualification to become Professor after studying Single Crystal Mössbauer Spectroscopy at Salzburg University, Austria, and was working in different scientific projects granted by the Austrian Fund of Scientific Research (FWF).

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