Neutron diffraction studies of nanostructured $SrFe_{12}O_{19}$ magnets

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Phase pure, highly crystalline $SrFe_{12}\ _{19}$ nanoparticles have been synthesized by hydrothermal and sol-gel synthesis methods. By varying synthesis parameters and method, $SrFe_{12}\ _{19}$ nanoplatelets of various sizes and morphologies can be obtained. The nuclear and magnetic structure of the samples have been studied by neutron and X-ray diffraction, revealing a clear size dependency on the long range magnetic order.

Subsequent compaction of the tailor-made powder samples into bulk magnets is carried out by Spark Plasma Sintering. Powder diffraction as well as X-ray and neutron pole figure analyses were performed on the compacted magnets. The obtained results, together with macroscopic magnetic measurements, reveal a direct influence between nanoparticle morphology, texture and magnetic performance. The platelet-like morphology of the nanoparticles leads to highly aligned magnets without the need of an externally applied magnetic field. Therefore, by varying the morphology of the platelets prior to compaction, the final magnetic properties of the sample can be tuned.

Meticulous characterization based on neutron and X-ray diffraction techniques reveals the relationship between synthesis conditions, crystal-, nano- and magnetic structure, and macroscopic magnetic performance. Extensive control over each step of the nanostructuring process is essential in the design of materials with tailored physical properties.

*1. M.Saura-Muzquiz, et al., Nanoscale,2016, **8**, 2857-2866.*