CMCC Mechanochemistry Discussions

Online Seminar Series

The Structural Disorder—Magnetism Relationships in Mechanochemically Synthesized Complex Nanooxides

Livestreaming at 10:00 AM (CT)

THURS., October 20, 2022

on the CMCC YouTube Channel:
https://www.youtube.com/channel/UC7eCYPKbGTKpgO7W2bNABxg

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https://www.int.kit.edu/1801_749.php

ABSTRACT:
The interplay of magnetism and structural disorder in mechanochemically processed complex oxides is a fascinating subject of recent interest [1,2]. The present work reviews a one-step mechanosynthesis and magnetic properties of magnetoceramics with a variety of structure types (cubic spinel, orthorhombic olivine, perovskite, hexagonal structure, double perovskite). The case studies are presented, focusing on recent progress in a fundamental understanding of the structural disorder–magnetism relationships in "interface-controlled" complex oxides prepared by mechanochemical routes. The far-from-equilibrium structural disorder in iron containing magnetic nanomaterials is studied by means of ^{57}Fe Mössbauer nuclear probe spectroscopy. The functional behavior of mechanosynthesized oxides is characterized by SQUID measurements. Selected examples of the separation of interfacial/surface effects from bulk effects in oxide nanoparticles are presented. It is demonstrated that interfacial effects in the mechanosynthesized ceramics may result either in an enhancement of magnetic behavior or in its degradation, *i.e.*, in a desired or undesired magnetic property modification, when compared to magnetism of their bulk counterparts prepared by a conventional ceramic method. The present work is supported by the DFG (project SE 1407/4-2).

[1] Tóthová, E.; Düvel, A.; Witte, R.; Brand, R. A.; Sarkar, A.; Kruk, R.; Senna, M.; Da Silva, K. L.; Menzel, D.; Girman, V.; Hegedüs, M.; Baláž, M.; Makreski, P.; Kubuki, S.; Kaňuchová, M.; Valíček, J.; Hahn, H.; Šepelák, V. A unique mechanochemical redox reaction yielding nanostructured double perovskite Sr_2FeMoO_6 with an extraordinarily high degree of anti-site disorder. *Front. Chem.* **2022**, *10*, 846910.
[2] Da Silva, K. L.; Trautwein, R. S.; Da Silva, R. B.; Fabián, M.; Čižmár, E.; Holub, M.; Skurikhina, O.; Harničárová, M.; Girman, V.; Menzel, D.; Becker, K. D.; Hahn, H.; Šepelák, V. Suppression of the cycloidal spin arrangement in $BiFeO_3$ caused by the mechanically induced structural distortion and its effect on magnetism. *Front. Mater.* **2021**, *8*, 17185.

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