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Exchange Bias in Ceramics: From Polyol Made $CoFe_2O_4$-core@CoO-Shell NPs to Nanostructured Ceramics

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Abstract : Tailoring bulk materials keeping their nanoscale properties is the daydream of material scientists. But especially in magnetism, this single desire can revolutionize our everyday life. Now, thanks to the methods of synthesis, based on the combination of colloidal chemistry (CC) to flash sintering (FS), customizing magnets becomes each time more 'easy', 'cheap' and 'clean'. Although by CC we can obtain straightway nanopowders with good magnetic featuring, like exchange bias (EB) phenomenon, it does not result so attractive for applications. Since a solid material is simple to manipulate and integrate in a device, many consolidation methods have been tested aiming to keep the nanopowders characteristics after consolidation. Unfortunately, the lack of structural crystalline arrangement and the grain growth worsen the magnetic properties. In this work, we exhibit, for the first-time author's best knowledge, the EB in sintered ceramics, starting from $CoFe_2O_4$-core@CoO-shell NPs obtained by CC. Despite the fact that EB field is about 28 mT in ceramics and it is not yet considered for applications, this work opens an alternative in the permanent magnets fabrication through a FS method, the spark plasma sintering, starting from CC synthesized nanopowders.

Keywords : core-shell nanoparticles, exchange bias, nanostructured ceramics, spark plasma sintering
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