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Potential of the NMR-in-magnetics technique in the study of local structure of various magnetic materials

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The lecture is devoted to nuclear magnetic resonance (NMR) in the magnetically ordered state of matter. The technique is also known as NMR in magnetics or spin echo, or FNR. This method possesses a considerable potential for effective investigation and testing of various magnetic materials, especially in the nanocrystalline and/or in nanocomposite state. In the first part of the lecture an introduction is done to basic physics of pulse NMR in magnetics together with a brief description of the method development since its appearance, about 60 years ago. The method was successfully applied to a lot of magnetics such as metallic cobalt and cobalt-containing materials, including films, multilayers and nanoparticles; various ferro- and ferrimagnetic compounds, Heusler alloys, intrinsically inhomogeneous perovskite-like CMR manganites etc. A number of works of different years demonstrate that NMR technique was the useful addition to well known diagnostic methods of magnetic materials and allowed one to get unique information. In the second part of the lecture we review applications of the technique to some novel magnetic structures/materials during the last few decades. In particular, we describe a determination of the core-shell structure of bimetallic FeCo nanoparticles, an observation of ferromagnetic clusters in spin-glass manganites far above Curie temperature, molecular magnets i.e., array of molecular complexes with several 3d-metal ions, Mn-doped magnetic semiconductors, and a detection of zero-field ^{13}C NMR signal in so-called magnetic carbon i.e., in carbon-based magnetic materials free from metallic elements.

Recent Publications

1. Matveev V V et al. (2007) ^{139}La NMR detection of ferromagnetic clusters far above the Curie temperature in $La_{0.7}Ca_{0.3}Fe_{0.09}Mn_{0.91}O_3$ spin-glass manganite. Journal of Physics Condensed Matter 19(22):226209.
2. Matveev V V et al. (2014) ^{13}C NMR relaxation and reorientation dynamics in imidazolium-based ionic liquids: revising interpretation. Physical Chemistry Chemical Physics 16:10480-10484.
3. Matveev V V et al. (2017) Investigation of melts of polybutylcarbosilane dendrimers by ^{1}H NMR spectroscopy. Scientific Reports 7:13710.
4. Markelov D A, Matveev V V et al. (2015) Determination of the hyperfine magnetic field in magnetic carbon-based materials: DFT calculations and NMR experiments. Scientific Reports 5:14761.
5. Markelov D A, Shishkin A N, Matveev V V et al. (2016) Orientational mobility in dendrimer melts: molecular dynamics simulations. Macromolecules 49:9247-9257.

Biography

Vladimir V Matveev has completed his PhD from Semenov Institute of Chemical Physics of USSR Academy of Sciences. He is a Senior Researcher of Department of Nuclear-Physics Investigation Techniques of Saint Petersburg State University, Russia. He has published more than 25 papers in reputed journals and made a lot of reports/lectures at international conferences.

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