

Growth and Functional Regulation of Inorganic Nanomaterials under Magnetic Fields

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Abstract

At first, I will briefly introduce the Chinese Steady High Magnetic Field Facility (SHMFF) and the accompanied experimental equipments, the focus is on the material synthesis and processing equipments under magnetic field.

Then, this report will introduce our recent research progress of inorganic nanomaterial growth and functional regulation under high magnetic field using SHMFF. It mainly introduces a novel method of magnetoinduced synthesis of heterogeneous Co_xSe nanosheets, and it is found that this method has a significant magnetic field effect on composition, morphology, magnetism, dielectric constant and microwave absorption performance. The study found that a strong magnetic field of 10 T can regulate the element ratio of the reaction products and reduce the x value of some Co_xSe from 0.85 to 0.5. Therefore, $\text{Co}_{0.85}\text{Se}/\text{Co}_{0.5}\text{Se}$ heterophase was prepared with the assistance of strong magnetic field. It is worth noting that the lateral size and thickness of Co_xSe nanosheets change simultaneously with the strong magnetic field, and the lateral size increases from nanometer to micrometer. Along with the changes in magneto-induced composition and morphology, it is interesting to find that the Co_xSe nanosheets transform from paramagnetism to ferromagnetism. In addition, the addition of a strong magnetic field significantly improves the magnetic loss, dielectric constant, and microwave absorption performance. Specifically, in the C band, the reflection loss increases more than tenfold, from -6.3 dB at 0 T to -66.3 dB at 10 T. These results indicate that the strong magnetic field-assisted synthesis technique can simultaneously regulate multiple structural and physical parameters of the material, which has great application prospects for multi-parameter materials engineering and may be used in a wide range of materials research.

Keywords: high magnetic field; inorganic nanomaterials; improved microwave absorption performance; Co_xSe nanosheets

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Biography:

Prof. Zhigao Sheng is the vice director of the Chinese High Magnetic Field Laboratory (CHMFL) of Chinese Academy of Sciences. He got Ph.D from Institute of Solid State Physics, CAS in 2007, and then be a postdoctoral fellow in the University of Hong Kong (07-08), the University of Tokyo (08-10), and the RIKEN in Japan (10-13). He focused on the research of spectrum technology, spectrum materials and spectrum devices under magnetic field, published more than 100 papers (Nature Phys., PRL, Nature Comm., Adv. Mater., etc.).

