Igor V Shchetinin et al., Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C6-030

Structure and magnetic properties of alloys based on $SmFe_{17}$ nitride after serve plastic deformation by torsion

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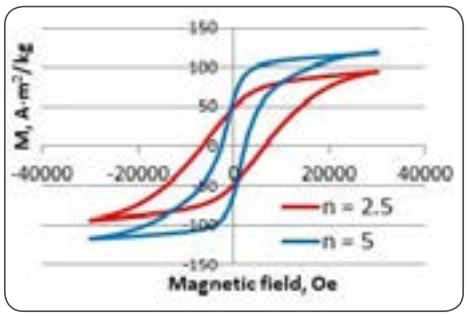
The nitrides of the Sm_2Fe_{17}-based alloys are promising for the development of permanent magnets because they have a high magnetic crystalline anisotropy constant, Curie temperature, and are cheaper than compounds like $Nd_2Fe_{14}B$. In this connection, study of structure formation and magnetic properties of alloys based on nitrides of the Sm_2Fe_{17} compound obtained by the methods of extreme effects is the actual task. It this work, we show that alloys in the initial state and after the hydrogenation and dehydrogenation processes contained the main phase of Sm_2Fe_{17} and a small amount (<2%) of α-Fe nitriding resulted in increased of Sm_2Fe_{17} lattice spacing without formation of new phases. After severe plastic deformation by torsion (SPDT), diffraction patterns of the alloys revealed a strong broadening of the diffraction lines which indicated the formation of a dispersed structure and was confirmed by SEM data: the formation of an equiaxial structure in the sample with an average grain size of 20 nm. In addition, according to X-ray diffraction analysis, the fraction of α-Fe increased in the SPDT process due to the local heating of the sample and leads to decomposition of $Sm_2Fe_{17}N_{2.8}$ phase. The hysteretic properties of the alloys changed in an extreme: under deformations with n = 2.5, the coercive force was increased to 6.5 kOe, and an increase in the degree of deformation led to a decrease in the coercive force, with the formation of a characteristic loop of magnetic hysteresis. As a result of the deformation at 77 K, nitride decomposition was not observed which confirms the heating of the material during deformation at room temperature.



Recent Publications

1. Glezer A M, Timshin I A, Shchetinin I V, et al. (2018) Unusual behavior of long-range order parameter in Fe_3Al superstructure under severe plastic deformation in Bridgman anvils. Journal of Alloys and Compounds DOI: 10.1016/j.jallcom.2018.02.124.
2. Romankov S, Park Y C and Shchetinin I V (2018) Structural transformations in (CoFeNi)/Ti nanocomposite systems during prolonged heating. Journal of Alloys and Compounds 745:44–54.
3. Savchenko A G, Medvedeva T M, Shchetinin I V, et al. (2017) Phase-structural state diagrams and hysteresis properties of rapidly solidified alloy $Nd_{10.4}Zr_{4.0}Fe_{75.1}Co_{4.1}B_{6.4}$ after heat treatment. Journal of Alloys and Compounds 707(2017):20–209.
4. Menushenkov A P, Ivanov V G, Shchetinin I V, et al. (2017) XMCD study of the local magnetic and structural properties of microcrystalline NdFeB-based alloys. JETP Letters 105(1):38–42.

Biography

Igor V Shchetinin has completed his PhD in the year 2012 from National University of Science and Technology. He is the head of X-ray structure analysis and diagnostic of materials laboratory. He has published more than 60 papers in reputed journals and has been serving as an Editorial Board Member of repute.

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