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INFLUENCE OF FLOODING ON COMPOUNDS AND FILMS OF THE Gd-Fe SYSTEM

Viktor Prysyazhnyuk
Department of Metal Physics of Ivan Franko National University of Lviv.
viktor.prysyazhnyuk@lnu.edu.ua

In the physics of materials, a new tendency of chemical-thermal processing of metals is intensively developing, the essence of which is the use of hydrogen as a technological environment in the processing of functional materials. Such hydrogen technologies are based on the patterns of hydrogen influence on phase transformations in metals. In particular, we are talking about polymorphic transformations, atomic ordering, formation and decay of intermetallic phases and hydrides. The most well-known hydrogen process that affects the formation of the phase-structural state of the material is HDDR (hydrogenation, disproportionation, desorption, recombination). Completion of the HDDR process at different stages leads to very different results.

Massive samples and films of Gd-Fe_2 compounds were studied by HDDR methods. We used two flood schemes: 1) The crushed Gd-Fe_2 samples were under a pressure of $2x10^6$ Pa for 168 hours at room temperature. 2) The crushed samples of Gd-Fe_2 were under a pressure of 10^6 Pa for 30 minutes at temperatures of about 700K. In the first case, hydrogen penetrated the lattice, deforming it. The amount of absorbed hydrogen depends on how finely ground our powder, in the case of thin films, the amount of absorbed hydrogen increases sharply compared to the mass of the "absorber". Electrographic studies of films before and after flooding indicate that such films have become finer. When heating the flooded samples, the reverse process of hydrogen evolution was observed, as evidenced by chemical analysis of the air in the heating chamber. It is possible to use such multi-layered structures to create hydrogen batteries. In the second case, hydrogen reacts with Gd-Fe_2 to form GdH_2 and GdH_3 plus free Fe. As evidenced by the destruction of the sample (turned into powder) and diffraction studies.

Unfortunately, the second method is not very productive for films. But such hydrogen treatment can be used to influence the magnetic properties of the obtained powders, because it forms an anisotropic structure of magnetic materials.