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НАЦІОНАЛЬНА АКАДЕМІЯ НАУК УКРАЇНИ

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XVIII МІЖНАРОДНА ФРЕЙКІВСЬКА КОНФЕРЕНЦІЯ З ФІЗИКИ І
ТЕХНОЛОГІЇ ТОНКИХ ПЛІВОК ТА НАНОСИСТЕМ

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Flooding processes in the Gd-Fe system

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In modern materials science, a new direction of chemical and thermal treatment of metals is intensively developing, which consists in the use of hydrogen as a technological environment in the process of processing functional materials. Such hydrogen technologies are based on the laws of the influence of hydrogen on phase transformations in metals, including polymorphism, atomic ordering and the formation and decay of intermetallic phases and hydrides. A known process that affects the formation of the phase-structural state of the material is HDDR (hydrogenation, disproportionation, desorption, recombination). If you complete the HDDR process at different stages, you can get very different results.

The Gd-Fe₂ compounds and films and two flood schemes were used for the study – 1) The crushed Gd-Fe₂ samples were under a pressure of 2×10^6 Pa for 168 hours at room temperature. 2) The crushed samples of Gd-Fe₂ 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-Fe₂ to form GdH₂ and GdH₃ 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.