Nanostructured surfaces

Structural transformations in austenitic stainless steel induced by deuterium implantation: irradiation at RT

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Deuterium thermal desorption spectra were investigated on the samples of austenitic steel 18Cr10NiTi preimplanted at 295 K with different deuterium ion doses. Based on these spectra, desorbed deuterium variations and the deuterium retention coefficient were plotted as functions of the ion implantation dose [1].

The discrete behavior of the deuterium capture rate with an increase in the implantation dose points to certain qualitative changes in the material structure, caused by structure rearrangements in the deuterium depth profile due to both the radiation influence and the increasing implanted deuterium concentration.

Three characteristic regions with different rates of deuterium amount desorption as the implantation dose increases, were revealed:

(I) – the linear region of low implantation doses (up to 1×10^{17} D/cm^2);

(II) – the nonlinear region of medium implantation doses (1×10^{17} to 8×10^{17}D/cm^2);

(III) – the linear region of high implantation doses ($8x10^{17}$ to $3x10^{18}$ D/cm^2).

The low-dose region is characterized by formation of deuterium-vacancies complexes and deuterium solid solution phases in the steel. The total concentration of the accumulated deuterium in this region varies between 2.5 and 3 at.%.

The medium-dose region is characterized by the radiation action on the steel in the presence of hydrogen with the resulting formation of the nanosized crystallite structure having a developed network of intercrystalline boundaries. This structure shows stability against the action of deuterium ion implantation (i.e., the radiation-resistant structure).

The total concentration of the accumulated deuterium in the region of medium implantation doses forms the structure, which is capable of retaining 7 to 8 at.% of deuterium.

1. *Morozov O., Zhurba V., Neklyudov I., Mats O., Rud A., Chernyak N., Progolaieva V.* Structural transformations in austenitic stainless steel induced

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