Nanostructured surfaces

Structural transformations in austenitic stainless steel induced by deuterium implantation: irradiation at 600 K

O. Morozov, V. Zhurba, O. Mats, I. Neklyudov, V. Progolaieva

National Science Center "Kharkiv Institute of Physics and Technology", NAS of Ukraine. 1, Akademichna St.,UA-61108, Kharkiv, Ukraine.
E-mail: morozov@kipt.kharkov.ua

Structural transformations in austenitic stainless steel induced by deuterium implantation at 600 K (D, 24 keV) were investigated by TEM and TDS methods. The TDS technique has been used to investigate the kinetics of spectrum development for deuterium desorption from steel 18Cr10NiTi versus the temperature irradiation and implanted deuterium dose.

Using the deuterium thermodesorption spectra from the steel samples exposed to different doses, we have plotted the total amount of deuterium desorbed from the sample as a function of the temperature and radiation dose (fig. 1). The increase on irradiation temperature is accompanied by decrease in concentration deuterium (~1 at.%, 600K).

At a temperature of 380 K, the TDS from steel exhibit a wide deuterium desorption region extending from 380 to 1200 K, with poorly resolved peaks having T_{max}~ 500 K, 700 K and 1050 K (local structure).

Fig. 1. Amount of desorbed deuterium versus irradiation dose for austenitic steel implanted at different temperatures

At temperatures of 420 and 600 K, the TDS show an extended region of deuterium desorption in the temperature range from the radiation temperature up to 1200 K, treated as being due to diffusion processes in the implantation layer. In this case, structureless regions are formed along the crystallite-local structure boundaries; steel components segregation also takes place.