

RADIATION-INDUCED ELASTIC AND INELASTIC EFFECTS IN METALS

K.M. Mukashev^{1*}, A.D.Muradov¹, F.F. Umarov²,
G.Sh.Yar-Mukhamedova¹

¹Kazakh National University after al-Farabi, Almaty, Kazakhstan

²Kazakh-British Technical University, Almaty, Kazakhstan

*e-mail: mukashev.kms@gmail.com

In this work we have performed a systematical investigation of energy dependence of the radiation defects distribution profile in three different materials irradiated by high energy protons. As the test objects we used polycrystalline Mo and Ta, and stainless steel-VD 10H18N10T as a foil with a thickness of 100 μm and a diameter of 17 mm each. The initial state of the metals achieved by annealing at $T = 1200^\circ\text{C}$ and for steel the temperature was at 1050°C for 1.5 hours in a vacuum of 10^{-5} Pa. Irradiation was carried out by 30MeV protons flow $1.2 \times 10^{13} \text{ cm}^{-2}\text{s}^{-1}$ up to $2 \times 10^{17} \text{ cm}^{-2}$ fluence. The main research tool in this case is the electron-positron annihilation (EPA) method. This method is a very sensitive tool to various kinds of damages of crystal structure /1, 2/. It has been shown that in the stainless steel and tantalum, regardless of proton energy, the vacancy complexes similar by configuration appear which are described by the slightly expressed elastic channel. The defects recover in one annealing stage with different migration activation energy. At the same time the molybdenum radiation damageability consists of two components in each of which exists its own mechanism of defects formation. For high energy protons what's important is the inelastic channel of interaction and formation of sub cascades. However, for low energy protons, the processes of elastic interaction with lattice atoms and emergence of atomic hydrogen in the end of the range are important.

REFERENCES

1. Leonard K.J. Comprehensive Nuclear Materials, 2012, Vol.4, PP.181-213.
2. Mukashev K.M., Tronin B.A. and Umarov F.F. Rad. Effects & Defects in Solids, 2009, Vol.164, N10, PP.611-618.