

Title: Interaction of tokamak plasma with selected fusion materials

Author: Veronika Klevarová

Department: Department of Physics of Materials

Supervisor: Doc. RNDr. Miloš Janeček, CSc.

Supervisor's e-mail address: Milos.Janecek@mff.cuni.cz

Abstract: The following work is devoted to structural analysis and study of relevant physical properties of materials with perspective use for the first wall and as construction materials of the tokamak device, prior to their interaction with the high-temperature plasma in Compass-D tokamak. The theoretical part contains an introduction to the interaction of tokamak plasma with fusion materials, including a description of the processes taking place during the plasma discharge (such as implantation, erosion, particles traveling in the tokamak vacuum vessel, redeposition, co-deposition with tritium etc.) and selection of appropriate fusion materials. The experimental part consists of structural analysis of selected materials by optical and scanning electron microscopy. Analysis of the structure revealed the presence of oxide layers in some samples prepared by the technology of plasma spraying; which was probably caused by sample preparation in the ambient air. Qualitative elemental analysis of the samples was performed by electron dispersive X-ray spectroscopy (EDS) in SEM. Presence of impurities was revealed at the bulk materials (tungsten and ODS steel), whose source is probably the air. Moreover, a silicon admixture was found in the sample of ODS steel. Study of microhardness confirmed that the hardest studied sample was the bulk tungsten. Thermal conductivity of ODS steel showed a temperature dependence and its values were around 33 W/m.K.

Keywords: thermonuclear fusion, tokamak Compass, fusion material properties