Investigation of the electronic structure of cerium heavy-fermion systems under exposure to dense flux of low-energy neutrino

V.A. Trapeznikov, I.N. Shabanova, A.V. Murin

Physical-Technical Institute, the Ural Branch of the Russian Academy of Sciences, Izhevsk

e-mail@xps@fti.udm.ru

The class of compounds based on x-elements (Ce) attracts considerable attention owing to their unique properties. They are characterized by heavy-fermion state, which occurs at certain external actions. A heavy fermion is a mixed formation consisting of strongly localized f states and Fermi sd-electrons. In the formation, sd-electrons become very heavy, their effective mass increases by 2-3 orders and their density grows near Fermi level. Heavy-fermion materials have unique properties. For example, when deposited upon components of machinery and mechanisms, they improve their strength by more than one order of magnitude.

The goal of the work is the investigation of changes in the electronic structure of some cerium systems under exposure to dense neutrino flux in order to develop a technology for significant improvement of material properties. Diffraction effect is used for increasing the neutrino flux density by several orders []. It is offered to use a powerful neutrino beam to produce an effect on heavy-fermion materials covering components of machinery and mechanism in order to improve functioning of the components or to make them fail by heat (kT) generated by neutrino beam. The indicated use of neutrino beams is practical, since the distance between the target and the neutrino source can be as large as is wished.

The investigation of the electronic structure of cerium systems has been carried out on the electron magnetic spectrometer [] using the X-ray photoelectron spectroscopy method and the calculations of the state density at various temperatures. It is shown that the position of the valence band maxima and the valence band width change relative to Fermi level. The maximum shifts by 0.3 – 0.5 to large binding energy due to a decrease in temperature. The intensity of the localized 4f maximum near Fermi level decreases with increasing temperature. The experimental results obtained are in good agreement with the calculated data.