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Characteristics of the annihilation of positrons in nanosized metal coatings Zr/Nb after He+ ion irradiation

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The samples were analyzed by means of annihilation line Doppler broadening (DB) spectrometry using variable positron energy at the Dzhelepov Laboratory of Nuclear Problems, JINR in Dubna, Russia. A monoenergetic positron beam 4 mm in diameter was used; the positron energy varied from 0.1 keV to 22 keV. Annihilation γ radiation was recorded by the HPGe detector model GEM25P4-70 (AMETEK ORTEC, Oak Ridge, TN, USA) with an energy resolution of 1.20 keV, interpolated for an energy of 511 keV. The obtained DB spectra were analyzed by estimating the parameters S and W of the annihilation line, as well as graphical representation of the R parameter as a function of S = f(W). The study of the radiation resistance of thin films was carried out by irradiation with helium ions in the low-energy channel of the DC-60 ion accelerator (channel of the electron-cyclotron resonance source) up to an ion fluence of 2·1017 ion/cm2. During irradiation, the temperature of the samples did not exceed 200 ℃. A layer-by-layer analysis of positron annihilation in Zr/Nb NMCs shows that irradiation by He+ ions with dose 2·1017 ion/cm2 leads to the formation of stable radiation defects. Once the energy reaches 20 keV, the probability of positron annihilation in the monocrystalline silicon substrate increases [1,2].

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