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Defect range and evolution in swift Xe-ion irradiated pure silver and titanium studied by positron annihilation techniques

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Positron annihilation spectroscopy is widely used for open volume defects identification in metals, alloys, semiconductors and other. However, it can be also applied for determination of defect spatial distribution in samples exposed to the surface treatment. This allows us to observe and recognize processes accompanying different treatments. The lecture will address the heavy ions implantation studied by positron annihilation spectroscopy including investigations performed by the author.

Implantation of energetic ions have been widely used to modify properties of the near surface region. It is important to understand the defect production, annihilation and migration mechanisms during and after collision cascades. In our studies, polycrystalline pure titanium and silver were irradiated by Xe^{26+} ions with kinetic energy of 167 MeV and different doses. Slow positron beam and positron lifetime were used for detection of defects. We intend to focus on the total range of defects after irradiation. For this purpose we applied with success the sequenced etching technique which was previous used for detection of subsurface zone created during sliding (see e.g., [1]). Despite the small range of the Xe^{26+} implantation, i.e., 10 μm this technique allows to detect the defect depth profile induced by irradiation. The profile range coincidences with the range of ion calculated using SRIM/TRIM code. However, the shape of defect profile does not coincidence with this calculated from the code. No Bragg peak at the end of the range is observed. We will discuss also the so called long range effect. This effect predicts the expansion of defects beyond the ion implantation range [2, 3]. The slow positron beam results for these samples will be also presented.

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