The effect of electron and gamma irradiation on the quality of surface and reflection of silver mirror coated by TiO$_2$ and Ta$_2$O$_5$

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Abstract
In this study, the effects of gamma and electron radiation on reflectivity of silver mirrors coated by TiO$_2$ and Ta$_2$O$_5$, in the wavelength range 250 to 1100 (nm) has been investigated. The coatings are considered for space applications in LEO orbit at 500 (km) from the earth surface for three-year mission in space. Electron and gamma dose absorbed within the three-year are respectively about 7.5 (KGy) and 0.4 (KGy) in this orbit. To measure the resistance of TiO$_2$, gamma radiation with CO$^{60}$ irradiation source was applied on the sample in the range from 0.2 to 20 (KGy) including dose 400 (Gy) at the desired height. At the highest dose, 20 (KGy), radiation effects on both samples were compared with each other. The atomic force microscopy was used to investigate the effect of radiation on the quality of samples surface after radiation, and an spectrophotometer was used to measure the samples reflection before and after radiation. The results showed that in spite of very minor surface changes, and color change of the mirror substrate, its reflection remains unchanged with TiO$_2$ and Ta$_2$O$_5$ coatings.

Keywords: radiation effect, electron, gamma, silver mirrors, TiO$_2$ coating, Ta$_2$O$_5$ coating

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