

Study of Laser Induced Damage Threshold in HfO₂/SiO₂ Multilayer Films after β -Ray Irradiation

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Abstract : Post-processing can effectively improve the resistance to laser damage in multilayer films used in a high power laser system. In this work, HfO₂/SiO₂ multilayer films are prepared by e-beam evaporation and then β -ray irradiation is employed as the post-processing method. The particle irradiation affects the laser induced damage threshold (LIDT), which includes defects, surface roughness, packing density, and residual stress. The residual stress that is relaxed during irradiation changes from compressive stress into tensile stress. Our results indicate that appropriate tensile stress can improve LIDT remarkably. In view of the fact that LIDT rises from 8 J/cm² to 12 J/cm², i.e., 50% increase, after the film has been irradiated by 2.2×10^{13} /cm² β -ray, the particle irradiation can be used as a controllable and desirable post-processing method to improve the resistance to laser induced damage.

Keywords : β -ray irradiation, multilayer film, residual stress, laser-induced damage threshold

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