

PERFORMANCE AND LIFETIME OF FINAL OPTICS FOR A LASER-IFE POWER PLANT

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Abstract: The final optic for a laser-IFE power plant is a delicate, precision component which must meet stringent performance requirements and must survive an environment containing multiple damage threats. The two leading candidate concepts are a grazing incidence metal mirror (for a KrF laser operating at 248 nm) and transmissive refractive wedges (for a solid state laser operating at the third harmonic, 349 nm). First, we will examine the requirements for beam smoothness, intensity profile and steering on the final optic that arise due to target illumination requirements. Next, we will survey the damage threats and likely mechanisms for degradation of the optical properties. Emissions from the target chamber include neutrons and gamma rays, high-energy photons and ions, condensible gases, aerosol and particulates, and the laser itself. Limits on contamination and surface damage will be discussed with emphasis on the impact on optical performance characteristics.

Detailed studies have been performed in order to determine the laser-induced damage threshold of grazing incidence mirrors and the effect of surface defects and contamination. Both modeling and experimental results will be provided. These results provide a better understanding of the mechanisms for damage and help to verify the feasibility and limitations of grazing incidence metal mirrors.