High-endurance IBS Optics for Laser Processing

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Ultrafast lasers, such as Ti:Sapphire, Yb:YAG, Yb:KYW/KGW, and Yb-doped fiber lasers, have revolutionized multiple industrial and scientific fields by generating pulses as short as a few femtoseconds. Applications in precision machining, material processing, and microstructuring benefit greatly from the advancements in these lasers. Additionally, scientific fields like multiphoton microscopy and attosecond physics, along with medical sectors such as ophthalmology and dermatology, leverage high-power ultrafast lasers for various intricate tasks.

However, the strain on optics due to high-power, ultrafast pulses presents significant challenges. Optics with short lifetimes lead to decreased system efficiency, frequent maintenance, and increased downtime. Extending the operational life of optical components ensures uninterrupted manufacturing and significantly reduces the total cost of ownership.

The rising demand for precise microfabrication, particularly in semiconductor and biomedical device fabrication, requires advanced optics. Ion beam sputtering (IBS) optics provide a robust solution for high-capacity laser processing by offering broad spectral coverage from 193 nm to 5000 nm. IBS-coated optics deliver consistent performance across a wide range of applications, from UV lithography in semiconductor manufacturing to infrared polymer welding.

This abstract discusses the integration of IBS optics into high-power and short-pulse laser systems. Through theoretical analysis, experimental results, and case studies, we demonstrate how IBS optics enhance the efficiency, throughput, and precision of high-capacity laser processing.