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1.4 Dual Laser Holography for In-Situ Measurement of Plasma Facing Component Erosion

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A digital holography (DH) surface erosion/deposition diagnostic is being developed for 3D imaging of plasma facing component (PFC) surfaces in situ and in real time. Digital holography is a technique that utilizes lasers reflected from a material surface to form an interferogram, which carries information about the topology of the surface when reconstructed. As described in this paper, dual CO2 lasers at 9.271 and 9.250 microns illuminate the interrogated surface (at a distance of ˜ 1 m) in a region of ˜ 1 cm x 1 cm. The surface feature resolution is ˜ 0.1 mm in the plane of the surface, and the depth resolution ranges from ˜ 0.001 to ˜2 mm perpendicular to the surface. The depth resolution lower limit is set by single-laser and detector optical limitations, while the upper limit is determined by 2 pi phase ambiguity of the dual-laser synthetic wavelength. Measurements have been made “on the bench” to characterize the single-laser and dual-laser DH configurations utilizing standard resolution targets and material targets that were previously exposed to high flux plasmas either in the Prototype Material Plasma Exposure eXperiment (Proto-MPEX) or electro-thermal (ET) arc source. Typical DH measurements were made with 0.03 ms integration with an IR camera that can be framed at rates approaching 1.5 kHz. The DH diagnostic system is progressing towards in situ measurements of plasma erosion/deposition either on Proto-MPEX or the ET arc source.

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