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Anti-reflection surface structures on optics as an alternative to thin film anti-reflection coatings

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Anti-reflection surface structures (ARSS) are nano-scale features patterned directly into an optical surface that are designed to have low optical reflectance. They have been demonstrated to increase the transmission of an optical surface to >99.9% and are an attractive alternative to traditional thin film anti reflection (AR) coatings for several reasons. They provide AR performance over a larger spectral and angular range and unlike thin film AR coatings, they are patterned directly into the optic rather than deposited on its surface. As a result, they are not prone to delamination under thermal cycling that can occur with thin film coatings and their laser damage thresholds can be considerably higher. In this presentation, we summarize results for ARSS on a variety of optical materials including silica, germanium, magnesium aluminate spinel and a variety of laser crystals. We discuss scale-up of the technique and describe results for ARSS with dimensions as large as 33 cm. We describe a surface modification procedure that results in a superhydrophobic surface without a significant decrease in transmittance. Finally, we show results for optical performance of ARSS on silica windows following sand and rain erosion testing showing that they are suitable for use in harsh environments.

Biography

Jesse A Frantz has received his PhD in Optical Sciences in 2004 from the Optical Sciences Center at The University of Arizona. He has been working as a Research Physicist at NRL since 2004 where his research is focused on microstructured optical surfaces and novel thin film materials. He established and manages a Vacuum Deposition Cluster System Facility in NRL's Optical Sciences Division used for a variety of projects including the fabrication of advanced, multi-layer thin film devices for optical applications.

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