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Energy confinement and thermal boundary conductance effects on short-pulsed thermal ablation thresholds in thin films JOHN TOMKO, ASHUTOSH GIRI, University of Virginia, BRIAN DONOVAN, United States Naval Academy, DANIEL BUBB, SEAN O'MALLEY, Rutgers University - Camden, PATRICK HOPKINS, University of Virginia — Laser-induced ablation has become a general term referencing any laser-induced mass removal, with expected ejection mechanisms ranging from non-thermal, photomechanical spallation to a thermally driven vaporization process. On the nanoscale, the high densities of inclusions, defects, and interfaces can lead to thermal transport properties in materials that can be drastically varying from those intrinsic to their respective bulk phases. Thus, an understanding of the heat transport processes that drive material ablation in nanosystems in lacking. In this work, single-pulse ablation mechanisms of ultrafast laser pulses are studied for thin Au films on an array of substrates with varying physical properties. Using time-domain thermoreflectance, the interfacial properties of the thin-film systems are measured: in particular, the thermal boundary conductance. We find that an often used, and widely accepted relation describing threshold fluences breaks down at the nanoscale. Rather than relying solely on the properties of the ablated Au film, the ablation threshold of these Au/substrate systems is found the be dependent on the measured thermal boundary conductance. These results are discussed in terms of diffusive thermal transport and interfacial bond strength.

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