Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Infrared laser ablation of polystyrene from microseconds to picoseconds RICHARD HAGLUND, SERGEY AVANESYAN, KENNETH SCHRIVER, Vanderbilt University, MALTE DUERING, BARRY LUTHER-DAVIES, Australian National University, HEE PARK, AppliFlex LLC, SINGARAVELU SENTHILRAJA, Old Dominion University, MICHAEL KLOPF, Jefferson National Acceleratory Facility, MICHAEL KELLEY, College of William and Mary
— We describe experiments on both resonant and non-resonant infrared pulsed laser of polystyrene across time scales varying from microseconds to picoseconds for the purpose of determining the ways in which the rate of energy deposition changes the response of both the ablated material and the residual substrate. RIR-PLD has been shown to be a relatively low-temperature process leading to evaporation and deposition of intact molecules. We compare the characteristics of ablation craters and ablation plumes deposited by Nd:YAG and Er:YAG lasers, picosecond and nanosecond optical parametric oscillators, and two different infrared free-electron lasers with differing pulse profiles. The films were characterized by profilometry, digital optical microscopy, scanning electron microscopy, and Fourier-transform infrared spectroscopy. Based on the experiments and computational modeling, we discuss the constraints on laser parameters that produce non-destructive ablation by resonant infrared excitation.

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Date submitted: 20 Nov 2010 Electronic form version 1.4