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Direct observation of enhanced residual thermal energy coupling to solids in femtosecond laser ablation ANATOLIY VOROBYEV , CHUNLEI GUO, University of Rochester — We perform the first direct measurement of the thermal energy remaining in the bulk samples of metals and semiconductors following multi-pulse femtosecond laser ablation. In contrast to the previous belief that the thermal energy remaining in the ablated sample is negligible using femtosecond pulses, we show a significant amount of residual thermal energy deposited in various materials. In fact, with a sufficiently large number of pulses at high fluence, virtually all the incident laser energy can be retained in the sample. Several possible mechanisms are investigated for their role in residual heating, including laser-induced surface modification, exothermic chemical processes, and pressure effects. We show that the increase in sample absorptivity due to surface modification is the dominant factor for the enhanced residual heating at a sufficiently large number of applied pulses but this alone can not fully account for enhanced residual heating at a smaller number of pulses.

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