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Evaporation kinetics of CO_2 laser heated fused silica[1] SELIM ELHADJ, M.J. MATTHEWS, S.T. YANG, D. COOKE, J.S. STOLKEN, M.D. FEIT, LLNL — Laser-based machining strategies of optical surfaces remain mostly empirical, yet, systematic and controlled studies that relate gas chemistry and surface temperature to evaporation kinetics are limited, especially at extreme temperatures (>2800K) reached during laser irradiation. We present experimental results of CO_2 laser heating of silica in oxidizing and non-oxidizing environments, along with analysis of surface shape from which a near-equilibrium evaporation model is derived. Based on this model, temperature dependent enthalpies of evaporation are determined and compared to published results. This model reproduces experimental laser-etch rates, while still accounting for laser, mass transport, and gas chemistry parameters. Although heat and mass transport processes are complex and tightly coupled, general conditions for which such an approach can be used to guide laser-based evaporation will be presented.

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