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Binary solidification in confined geometries: Towards efficient solar cells TOBIAS M. SCHNEIDER, MICHAEL P. BRENNER, School of Engineering and Applied Sciences, Harvard University — Electrical properties of semiconductors are mainly controlled by the concentration of dopants. While the highest dopant concentrations reachable in most traditional doping methods are limited by the equilibrium solubility of the dopant in the pure semiconductor material, much higher concentrations are observed after femtosecond laser treatment of silicon in a sulfur containing atmosphere. We propose a mechanism underlying *Laser-Hyperdoping* by showing that the Laser induced melting dynamics of the silicon surface in combination with dopant diffusion alone can give rise to the observed high doping concentrations. Modeling the re-solidification of the binary silicon-sulfur mixture in a semi-infinite domain allows to predict the dependence of doping concentrations on depth and provides a method to control the shape of concentration profiles and thereby electrical properties of the semiconductor material. Controlling those properties in a range not accessible to traditional doping methods provides new avenues for optimizing the efficiency of photovoltaic cells.

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