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Optical Near-Field Based Nanoscale Rapid Melting and Crystallization of Amorphous Silicon Thin Films DAVID HWANG, ANANT CHIMMALGI, COSTAS GRIGOROPOULOS, Univ. of California Berkeley — Nanostructuring of thin films is gaining widespread importance owing to ever-increasing applications in a variety of fields. The current study details nanosecond laser-based rapid melting and crystallization of thin amorphous silicon (a-Si) films at the nanoscale. Two different near-field processing schemes were employed. In the first scheme, local field enhancement in the near-field of a SPM probe tip irradiated with nanosecond laser pulses was utilized. As a second approach, the laser beam was spatially confined by a cantilevered near field scanning microscope tip (NSOM) fiber tip. Details of various modification regimes produced as a result of the rapid a-Si melting and crystallization transformations that critically depend on the input laser fluence are presented. At one extreme corresponding to relatively high laser fluence, ablated area surrounded by a narrow melt region was observed. At the other extreme, where the incident laser energy density is much lower, single nanostructures with a lateral dimension of ~ 90 nm were defined. The ability to induce nucleation and produce single semiconductor nanostructures in a controlled fashion may be crucial in the field of nano-opto-electronics.

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