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Optimization and Characterization of Nanostructured Surfaces for Photon-Enhanced Thermionic Emission and Photoemission cathodes DANIEL RILEY, VIJAY NARASIMHAN, JOEL JEAN, IGOR BARGATIN, JARED SCHWEDE, ZHI-XUN SHEN, ROGER HOWE, NICK MELOSH, Stanford University — In the cathode of an energy converter based on photon-enhanced thermionic emission (PETE) photoexcited carriers may need to encounter the emissive surface numerous times before having sufficient thermal energy to escape into vacuum and therefore should be confined close to the surface. However, in a traditional planar geometry, a thin cathode results in incomplete light absorption. Nanostructuring has the potential to increase light capture and boost emission by decoupling the lengths associated with photon absorption and electron emission. Nanostructures may complicate the properties of the emissive surface; therefore, the effect of nanostructuring on emission efficiency needs to be studied. _We have recently reported preliminary theoretical results from a suite of simulation tools to capture the full photoemission process: photon absorption, carrier transport within the active material, and electron ballistics following emission. In this work we use the simulation suite to optimize nanostructures for applications including PETE-based solar energy converters, photodetectors and electron sources. The samples are then characterized, and the emission efficiency measured in an ultra-high vacuum test chamber under application-centric conditions.

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