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Embedded insulated metallic nanopatterns for enhanced optical absorption and photovoltaics FAN YE, MICHAEL J. BURNS, MICHAEL J. NAUGHTON, Department of Physics, Boston College, Chestnut Hill, 02467 — Recently, we have shown embedded metallic nanopatterns (EMN) in ultrathin PV films to be candidates for high efficiency thin-film solar cells, owing to prominent metamaterial/plasmonic-enhanced light trapping, as compared to unpatterned, surface- or bottom-patterned [1]. We also showed that hot electron effects emerge in ultrathin a-Si-based solar cells [2]. The EMN in the semiconductor layer, however, can also serve as a source of recombination for photogenerated electrons and holes, leading to decreased current. Here, we propose the idea of an embedded insulated metallic nanopattern (EIMN) to efficiently avoid the recombination effect while maintaining high light absorption in an ultrathin film format in which hot electron physics can contribute. Simulations show that an EIMN with a 10 nm layer of dielectric insulation provides essentially the same absorption as its EMN counterpart. Measurements on several EMN structures will be presented. This EIMN architecture may provide a practical route to high efficiency, hot electron solar cell technology using ultrathin films.
[1]F. Ye, M.J. Burns, M.J. Naughton, Proc. SPIE **8111**, 811103 (2011).
[2]K. Kempa, M.J. Naughton, Z.F. Ren, A. Herczynski, T. Kirkpatrick, J. Rybczynski, Y. Gao, Appl. Phys. Lett. **95**, 233121(2009)

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