Abstract Submitted
for the GEC20 Meeting of
The American Physical Society

Titanium nitride nanocrystal with a silicon oxynitride shell: an alternative material to gold for high temperature applications LORENZO MANGOLINI, CARLA BERROSPE RODRIGUEZ, ALEJANDRO ALVAREZ BARRAGAN, STEPHEN EXARHOS, GIORGIO NAVA, University of California, Riverside — The study of plasmonic nanomaterials like gold has been widely investigated due to their controllable optical properties and ease of production at a lab-scale level. However, due to their poor thermal stability and high cost, scienties have researched alternative plasmonic materials to overcome these. Titanium nitride (TiN) has considerably higher thermal stability than noble metals, high free carrier densities and display plasmonic properties in the visible to the near infrared (NIR) spectrum, which makes it suitable for biomedical applications. Despite the advantages of TiN, this material is susceptible to oxidation which degrades its high absorption response. We performed a comparative study between bare and core-shell TiN nanoparticles, with respect to their structural, chemical, and optical properties. These particles were synthesized in a non-thermal plasma reactor system, where TiN nanocrystals are nucleated in a first reactor and uniformly coated with silicon nitrate in a second reactor. We found that oxidation due to air exposure was reduced by the coating and significantly improves the plasmonic response of TiN. Finally, thin films with the core-shell structures presented no significant changes in their plasmonic response after being exposed to an inert atmosphere heated up to 900C. These results provide a deeper insight of the nitride-based plasmonic material's potential for high temperature applications, which overcomes the limitations of gold.

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Date submitted: 17 Jun 2020 Electronic form version 1.4