

Plasma electrochemical reduction for nanomaterial synthesis and assembly

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Abstract— We have recently developed a non-lithographic, dry approach to patterning films of metal nanoparticles based on plasma electrochemical reduction [1]. Plasma electrochemical reduction involves the transfer of electrons from a gas discharge to a liquid or film that contains ions. When the charge transfer reaction involves metal ions, the metal is reduced and particles are nucleated. Here, we will discuss experiments with both solutions and films to demonstrate the basic mechanism and application of plasma electrochemical reduction for nanoparticle synthesis. In the case of a film, the reduction is controlled over micron length scales, enabling microscale patterns of metal nanoparticles to be produced. We have applied this method to the formation of patterned films of Ag, Au, Pt, Ru, and Ir nanoparticles. Overall, the approach is generic, low cost, and scalable for roll-to-roll processing of thin film materials.

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REFERENCES

- [1] S. W. Lee, D. Liang, X. P. A. Gao, and R. M. Sankaran, *Advanced Functional Materials*, in press.