Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Electroless deposition of metal nanoparticles on graphene with substrate-assisted techniques[1] ANNA M. ZANIEWSKI, CHRISTIE J. TRIMBLE, VERONICA MEEKS, ROBERT J. NEMANICH, Arizona State University — We present the electroless reduction of solution-based metal ions for nanoparticle deposition on a variety of substrates. The substrates include graphene-coated metals, insulators, doped semiconductors, and patterned ferroelectrics. We find that the metal ions are spontaneously reduced on a wide variety of graphene substrates, and the substrates play a large role in the nanoparticle coverage. For example, the reduction of gold chloride to gold nanoparticles on graphene/lithium niobate results in 3% nanoparticle coverage compared to 20% coverage on graphene/silicon and 60% on graphene/copper. Given that the work function of graphene is approximately 4.4eV, the Fermi level is -0.1 V vs the normal hydrogen electrode (NHE). Since the reduction potential of gold chloride is +1.002 V, the spontaneous transfer of electrons from the graphene to the metal ion is energetically favorable. However, we find substrates with similar work functions nevertheless result in varied deposition rates, which we attribute to electron availability. We also find that patterned ferrolectrics can be used as a template for patterned nanoparticle deposition, with and without graphene.

[1]This work is supported by the National Science Foundation under Grant # DMR-1206935.

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Date submitted: 14 Nov 2014 Electronic form version 1.4