Abstract Submitted
for the SES17 Meeting of
The American Physical Society

Salt-Assisted Ultrasonicated De-aggregation and Advanced Electrochemistry of Detonation Nanodiamond.[1] SANJU GUPTA, B. EVANS, A. HENSON, Western Kentucky University — Nanoparticles in dry powder state form agglomerates thus reducing surface energy and accessibility of diamond core impacting technological advancement. In this work, we investigated a facile, cost-effective and contaminant-free salt-assisted ultrasonic de-agglomeration method for detonation nanodiamond, NDs. Utilizing ultrasound energy to break apart two different sourced and thermally treated nanodiamond mesoscale aggregates in sodium chloride and sodium acetate salts, this technique produced aqueous slurry of isolated or single-digit (<10 nm) stable colloidal dispersions by virtue of ionic interactions and electrostatic destabilization. Moreover, the technique is well-suited for materials engineering (composites, lubricants) and biomedical (bio-labelling, biosensing) applications. We characterized microscopic structure and performed advanced electrochemistry by immobilizing processed NDs on boron-doped diamond to study surface redox chemistry, determine surface potential (or Fermi level), carrier density and to image electrocatalytic activity by scanning electrochemical microscopy and the results are compared to those untreated aggregated nanodiamond particles. The findings are discussed in terms of surface functionality and defect sites that give rise to surface states within bandgap. These surface states may serve as electron donors (or acceptors) depending upon bonding (or antibonding) character suitable for various electrocatalytic redox processes.

[1]NSF-MRI and NSF KY EPSCoR Grants

Sanju Gupta
Western Kentucky University

Date submitted: 29 Jun 2017 Electronic form version 1.4