

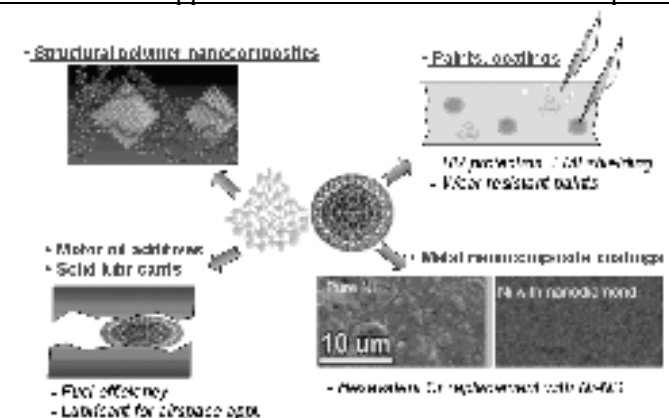
Detonation Nanodiamond and Onion-like Carbon: Applications in Composites

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Within the last 3-4 years world-wide interest in the area of detonation nanodiamond (DND) particles has grown rapidly¹. Numerous applications of DND are under development including high precision polishing; addition to metal coatings resulting in improved wear resistance; anti-friction additives to lubricants and oils; nanofluids for enhanced heat transfer (transformer oils, cooling in microelectronics); polymer nanocomposites and coatings with enhanced strength, impact resistance, scratch resistance, thermal degradation and thermal conductivity; UV-protection coatings, sunscreens; slurries for seeding for growth of CVD diamond films and many others areas. Also, DNDs serve as a source material for the production of onion-like carbon (OLC) by high temperature annealing of DND in a non-reactive (inert) atmosphere. Recently it was demonstrated that OLCs are strong absorbers of electromagnetic (EM) radiation from gigahertz to terahertz to visible spectral ranges, providing efficient EMI shielding. Several examples of applications under development at ITC and its collaborators using the modified/fractionalized DND will be discussed with major emphasis on applications of DND and OLC in composites (schematics below). It was also recently demonstrated that nanodiamond particles embedded to a polymer matrix attain photoluminescent properties when irradiated with a flux of MeV protons. This suggests an application of the ND-polymer coatings as fluorescence-induced indicators of a proton dose acquired, for example, by a spacecraft vehicle. We will report on the fabrication of novel composites of carbon nanotubes incorporated into a nanodiamond matrix producing mixtures from nanocarbons that are complementary in chemical and mechanical strength and are expected to produce unique physical properties. Photonic structures made of DND will be also discussed.

Schematics of applications of DND and OLC in composites:



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[1] *Ultrananocrystalline Diamond: Synthesis, Properties and Applications of* (eds O.A. Shenderova, D.M.Gruen (William Andrew Publishing, Norwich, NY, 2006).