

Cool Plasma Functionalization of Nanodiamond Particles

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It was demonstrated that an atmospheric pressure dielectric barrier glow discharge system is a powerful tool for the surface functionalization of nanodiamond particulate. Nanodiamond functionalization was performed in minutes using plasma discharges generated with nitrogen and fluorine containing gases. The chemical bonds formed between reactive species generated in the plasma and nanodiamond surfaces was confirmed by FTIR and XPS analysis. Following plasma fluorination XPS analysis revealed a relatively high concentration of F on the nanodiamond surface, up to 4-6wt%. FTIR analysis revealed the presence F-bands related to C-F, ?C-F, -CF₂, CF₃ and =C-F stretching vibrations, -CF₂ and CF₃ asymmetric stretching vibrations. Stable colloidal solutions of anisole with 0.5% by mass of nanodiamond were formed using these fluorinated nanodiamond particles, which are intrinsically hydrophilic and easily sediment in non-polar organic solvents otherwise. The degree of functionalization with a specific surface group depends on the surface chemistry of the initial nanodiamonds as well as on the type of the gas used for plasma generation.. Particularly, the use of CF₄ gas results in more efficient nanodiamond fluorination than SF₆.