WETTABILITY OF CNP NANOFILM OBTAINED WITH DIFFERENT HARVESTING PROCESS

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Abstract

Flame synthesis methods allow producing engineered thin films of carbon nanoparticles (CNPs) with tuneable properties that derives from the high capability of modern techniques used to control combustion and particle harvesting processes. Thin films of carbon particles are usually produced starting from carbon black (CB) particles and are superhydrophobic. Such superhydrophobicity derives from the chemical structure of the CBs and their arrangement on the film.

Flame synthesis allows producing CNPs that are with size significantly smaller than CBs, from few tens of nanometers down to few nanometers and also potentially with higher oxygen content that helps increasing their hydrophilicity. This peculiarity can help tuning CNP nanofilm wettability from superhydrophilic to superhydrophobic behaviors. However, the wettability of the film is not only a function of the particles properties, but also of the harvesting technique.

This poster reports preliminary results on the hydrophilic/hydrophobic response of CNP films produced by flame synthesis in a premixed ethylene/air flame (C/O = 0.67) generated with a McKenna burner, using two harvesting methods. The first one (named Hot Flame Harvesting, HFH) involves pure thermophoretic and electric-field assisted harvesting of CNPs by insertion of a cold substrate directly in a hot flame. The second one (named Cold Flame Harvesting, CFH) makes use of a dilution probe that extract particles from the flame and deposit them over the plates of a cold electrostatic precipitator.

The films and the substrates are analyzed using sessile drop methods, adopting both distilled water and water-based solutions to exploit different surface tensions, γ. The experiments reveal that the CFH film is phobic until γ remains above 0.036 N/m, where a transition from phobic to philic behavior occurs in a few seconds. The HFH films exploit such a fast transition also with the surface tension of pure water (γ = 0.073 N/m). This indicates that the harvesting process substantially alters the properties of the CNP films, due to particle dynamics from flame transportation to film deposition and the rearrangement of particles on the CNP deposits.

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