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Surface Modification of Nanostructured Solids

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This paper will focus on issues related to surface modification of nano-structured materials. Special coatings and surface treatments to modify surface properties (such as bonding, wettability, corrosion resistance, electrical & thermal properties) is not new, but new challenges emerge when the bulk structure to be coated is itself hundred nanometers in dimension. The coating thickness has to be substantially smaller than the bulk dimension, yet be effective. Examples of surface treatments and sub-nanometer coating formation on nano-fibers, near net shape cellular foams, woven materials etc will be discussed. Factors such as coating effectiveness, uniformity and engineering property changes at these small scales will be discussed. Liquid phase treatments, plasma enhanced coatings and multi-step combination methods have been investigated. It is seen that for some functional modifications, extremely thin coatings (nm or less) are sufficient and therefore easily applicable for structures that are few nanometers in size. For instance, Figure 1 shows two different coatings (each about 5 nm in thickness) that can completely change the surface wettability of a microcellular graphitic structure. Figure 2 shows the C1s photoelectron peaks from the untreated and the differently treated surfaces. Direct correlation can be established between surface chemistry, morphology and physical properties. Additional aspects of these treatments specific to different applications, such as durability and surface reactivity, their relation to functional properties of these solids etc. will also be discussed.

Figure 1: *Contact angle of water on graphitic foams (a) untreated (b) plasma treated for surface oxidation (c) plasma treated for water-resistance.*

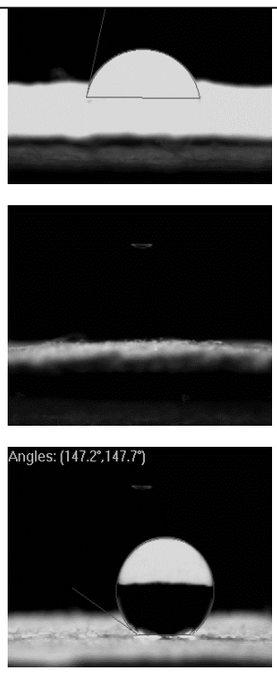

Figure 2: *C1s photoelectron peak from graphitic surface that has been coated for hydrophilic and hydrophobic behavior using plasma treatment. Correlation between surface chemistry and wettabilitv can be clearlv established.*