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Polymer nanocomposites for breathable applications

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ABSTRACT

Breathability, typically defined as the ability for moisture vapor to be transmitted through a material, is one of the properties that characterize polymer membranes, films, and textiles in several of their applications. The material's permeability in water vapor is the most critical parameter, which however is considerably low for several common polymers (e.g. polyolefins). To overcome this, inclusions are introduced in the polymer matrix. Carbon based materials, such as Carbon Nanotubes (CNTs) and Graphene based materials (Graphene, GOs and materials resulting from their structural manipulation) seem to be challenging since, at least from the theoretical point of view, they enable flow of water (and water vapors), which is orders of magnitude higher than the conventional theories of fluids predict. In the first part of the presentation, experimental results correlating the CNT concentration with the breathability of polyolefins will be demonstrated, hence outlining the potential use of similar composites in applications such as industrial/construction roofing membranes, breathable textiles, gas separation membranes etc. Analogous composites may be also used for water treatment achieving both increased fluxes and appreciable removal of organic pollutants. To this end, a spectroscopic method that evaluates the membrane's performance by offering identification and quantification of organic molecular species in treated water (even at extremely low concentrations) will be described in the second part of the presentation.