Utilizing Polymer Coatings for the Development of Superhydrophobic and Water Repellent Surfaces

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The development of superhydrophobic and water - repellent coatings has attracted considerable attention due to their wide range of applications. At the same time, polymer materials with optimized properties can be prepared by the incorporation of nano-additives in a polymer matrix, forming a composite material. In this work, we report on the development of superhydrophobic and water - repellent nanohybrid coatings, deposited on flexible Low-Density Polyethylene (LDPE) substrates that have been modified by Corona Treatment. The coatings consisted of a low surface energy polymer matrix into which inorganic nanoparticles of different size were incorporated. The surface properties were evaluated for both the bare and the coated substrates and in the latter case they highly depend on the kind of the polymer matrix (silane/siloxane mixture, fluoropolymer), the thickness of the coating, as well as on the content and size of the added inorganic nanoparticles. Contact angle (CA) and contact angle hysteresis (CAH) measurements revealed that the optimum coating exhibits a superhydrophobic (CA>150°) and water - repellent behaviour (CAH<5°), as shown in Figure 1. Further than their superhydrophobicity, the wetting properties of the coated surfaces against several organic solvents (Glycerol, Ethylene Glycol and Dimethyl Sulfoxide), showed strongly oleophobic behaviour as well. The surface topology and roughness of the coatings were studied by Scanning Electron Microscopy (SEM) providing complementary information towards the interpretation of the results. Furthermore, the optical and thermal properties of the coated LDPE films were evaluated and the transmittance and thermal transitions of the initial LDPE were found unaffected by the presence of the coating. The combination of superhydrophobobicity and in certain cases amphiphobicity, low roll off angles and antidust properties make these coatings ideal candidates for greenhouse applications.

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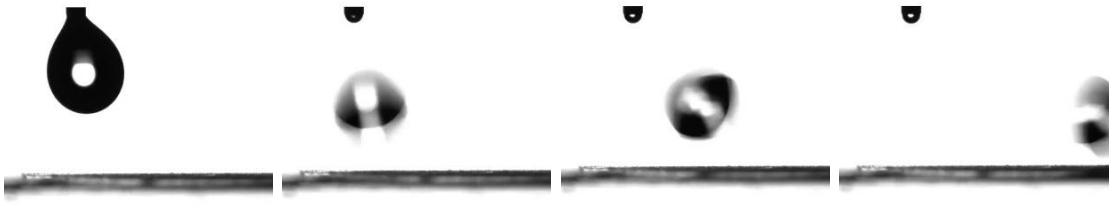

Figure 1: Water - repellent behavior of nanostructured coating deposited on LDPE substrate.

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