Improved radiation resistance of a polymer by silica coating

An environment and human friendly technique for improved performance of materials

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We demonstrate that deposition of gas barrier film is effective to suppress radiation oxidation of a polymer and can improve its radiation resistance. The gas barrier silica films were successfully formed on polypropylene by magnetron sputtering. Long-term irradiation of cobalt-60 gamma-rays in air resulted in oxidation of samples without silica coating, whereas samples with silica coating were hardly oxidized. Furthermore, the radiation resistance of polypropylene was significantly improved by silica coating. Because of non-toxicity of silica, the technique may be applicable to polymeric medical items subjected to radiation sterilization.

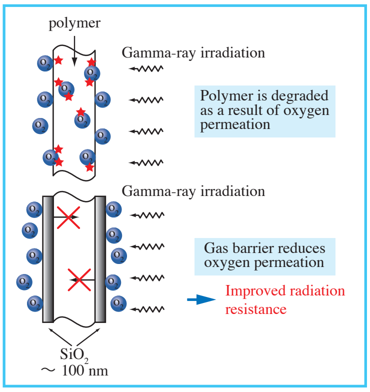

Figure 1: Improved radiation resistance of polymers by gas barrier silica coating.

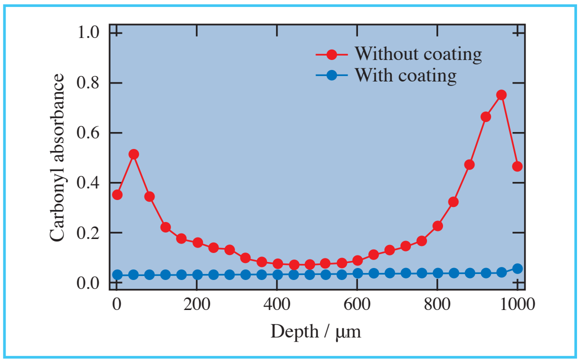

Figure 2: Depth profile of carbonyl groups formed in polypropylene of 1mm thickness after gamma-ray irradiation for 2000 h in air. Gas barrier silica films suppress oxidation of the coated sample.

Superhydrophobic surface fabricated from hydrophilic materials

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Super-hydrophobic surface (contact angle : 178 degrees) has been fabricated from hydrophilic material through a nano-structure control technique. Nanometer-sized pins, which align perpendicular to surface, were grown from Co aqueous solution, and the pins were coated with lauric acid, subsequently. The surface with the pins of 6.5nm diameter showed super-hidrophobicity even the pins were hydrophilic.

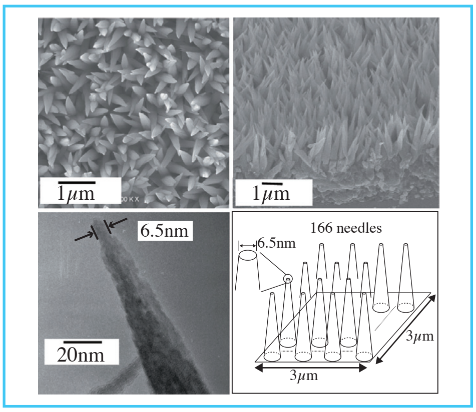

Figure 1: (top-left,top-right) FE-SEM images of the nano-pin films observed from the top and side, respectively. (bottom-left) TEM images of the nano-pin films (bottom-right) Simple model of the film with the fractal structure.

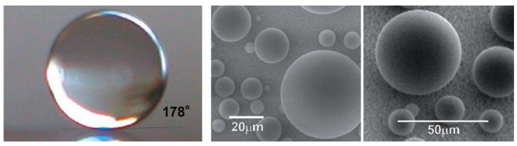

Figure 2: (Left) the image of the water on the nano-pin film. (Center,Right) E-SEM images of the water on the nano-pin films observed from the top and side, respectively.

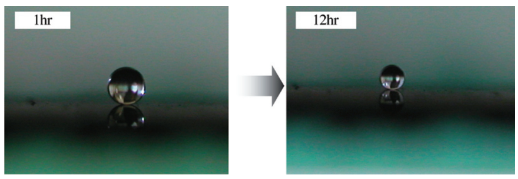

Figure 3: The stability of the Superhydrophobic surface fabricated from the nano-pin.