Surface Modifications of Polyamide Fiber for Nanoparticles Coating through Low Temperature plasma and UV excimer laser treatments

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Recently, there has been great interest in physico-chemical treatment for modifying polymer surfaces [1-5]. Low temperature plasma treatment and UV Excimer laser irradiation are of particular interest in morphological and chemical modifications of the polymer for nano-particles coating.

Plasma-treated and laser-irradiated samples were studied by scanning electron microscopy (SEM), atomic force microscopy (AFM), x-ray photoelectron spectroscopy (XPS) and chemical force microscopy (CFM). Topographical results indicated that ripple-like structures of micrometer size formed after the laser irradiation. XPS and CFM results showed that bond scission occurred on the polymer surface under the action of laser treatment. In contrast, low temperature plasma formed ripple-like structures in sub-micrometer size. The plasma treatment increased surface oxygen content of polyamide and induced many hydroxyl (-OH) and carboxylic acid (-COOH) functional groups.

It was found that there is a strong interfacial interaction in the plasma-treated and laser-irradiated polymer-coated nano-particles. The adhesive properties and surface metallization of the modified material were significantly improved due to the increased surface area and functional groups.

References:
[1]Yip J., Chan K., Sin K.M. and Lau K.S., Applied Surface Science (2002), in press.
[2]Yip J., Chan K., Sin K.M. and Lau K.S., Color. Technol. 118 (2002) p. 26 and p. 31.
[3]Yip J., Chan K., Sin K.M. and Lau K.S., J. of Materials Processing Technology, 123 (2002) p.5-12
[4]Yip J., Chan K., Sin K.M. and Lau K.S., Mater Res Innov, 6(2) (2002) p.44-50
[5]Yip J., Chan K., Sin K.M. and Lau K.S., Mater Res Innov, 6(2) (2002) p.73-78

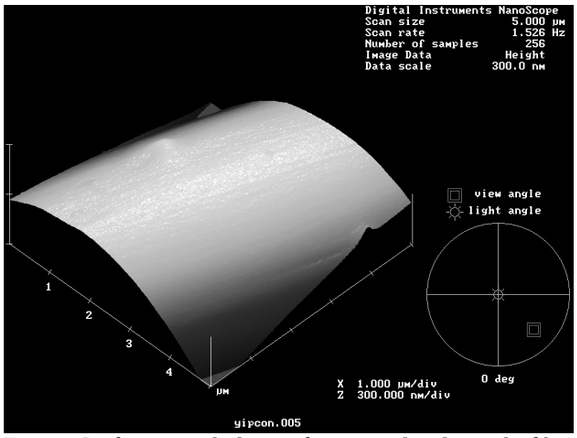

Fig. 1. Surface morphology of untreated polyamide fiber at the micrometer scale (1 µm x 1 µm)

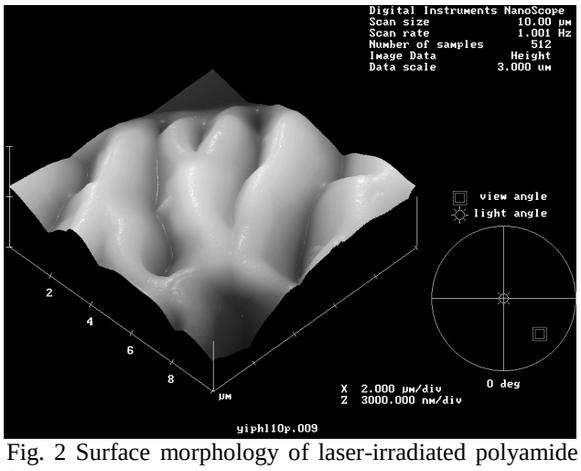

Fig. 2 Surface morphology of laser-irradiated polyamide fiber at the micrometer scale (10 µm x 10 µm)

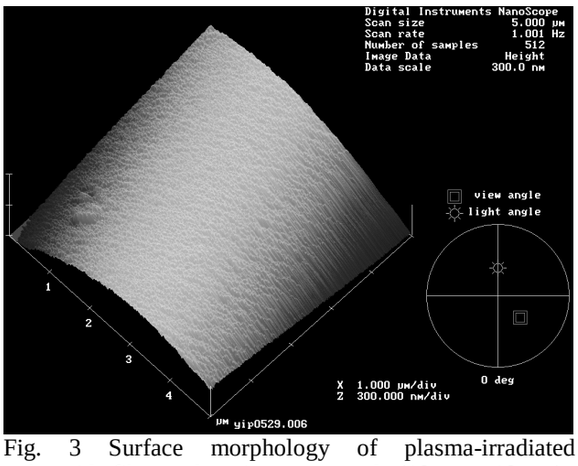

Fig. 3 Surface morphology of plasma-irradiated polyamide fiber at the micrometer scale (10 µm x 10 µm)