TOPICS

Coating on Plastics Treated by Laser Ablation without Primer

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樹脂の下塗り塗装に代わるレーザーアブレーション処理

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In general, adhesion of coating film to the surface of plastics is insufficient for practical usage. Coating films painted directly on plastics without primer tend to come off easily. Therefore, usually a primer is applied on plastics before coating. However, applying primer increases the cost and complicates the manufacturing process. Therefore, direct painting on plastics without primer is desired.

The laser ablation with vacuum ultra violet (VUV) light having wavelength between 60 nm and 80 nm in a vacuum chamber[1] can improve adhesion characteristics of the plastic surface, and has been developed as a new plastic surface treatment. In this short communication, the effectiveness of this treatment is exemplified and its working mechanism is considered. The laser ablation treatment with VUV was applied on polypropylene substrates, and the treated samples were directly coated with a metallic basecoat and a clearcoat. After baking the painted samples at 363 K for 20 min. and dipping them for 10 days in a water bath at 313 K, samples were cross-cut with a knife and pulled with an adhesive tape stuck to the surface (cross-cut test) to examine the adhesive strength between the plastic surface and the coating. The coating films were not torn off from the treated plastic surfaces as shown in **Fig. 1**. In contrast, without the treatment, the films were easily torn off from the plastic substrates. In addition, the samples treated in a helium atmosphere of 1.01325×10^5 Pa instead of under vacuum were tested in the same way. The sample treated in helium gas exhibited weaker but practically sufficient adhesion strength.

The photoelectron spectra of C1s electrons of plastic surfaces with and without laser ablation with VUV in X-ray photoelectron spectroscopy analysis (XPS) are shown in **Fig. 2**. Compared with the untreated sample, the spectrum of the sample with VUV laser ablation has a broadening on the high energy side, which broadening is caused by the bonding between carbon and oxygen or carbon and hydroxyl group. From this result, it seems that a carbonyl radical and a hydroxyl radical were formed on the plastic surface, intensifying the adhesion strength between the coating and the substrate.

Reference

1) Azuma, H., et al. : "New Surface Treatment of Polymers by Simultaneous Exposure to Vacuum Ultra-Violet Light and Nanometer-Sized Particles", Jpn. J. Appl. Phys., **43**-10(2004), 1250-1252

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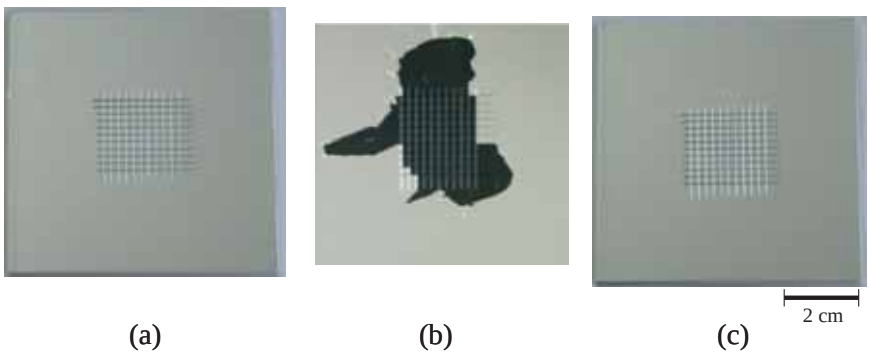

Fig. 1 The results of the cross-cut test for samples, (a) treated with laser ablation with VUV and without primer, (b) untreated without primer, and (c) with primer.

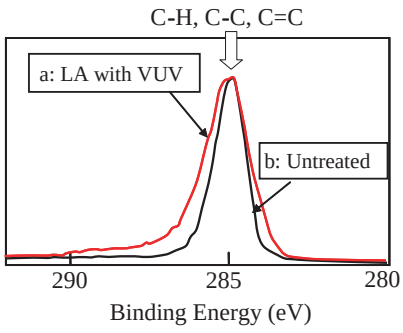

Fig. 2 XPS spectra of C1s electrons on plastic surfaces, (a) treated by laser ablation with VUV and (b) untreated.