29a-F1-9

プラズマ照射 PET フィルム直接接合効果の失活：表面形成官能基の薬液耐久性

Inactivation of Bonding Effect of Plasma-irradiated PET Films by Various Liquid Reagents : Durability of Surface Functional Groups for Various Liquid Reagents

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INTRODUCTION

When polymers are irradiated by plasma, functional groups are created at the surface. Then the surface becomes active, but its lifetime is very short. We have developed the direct bonding technique that homogeneous and heterogeneous plastic films can be bonded by the plasma irradiation [1],[2]. The direct-bonded aramid-paper/polyimide laminate is now used in the high-speed train as insulating sheet. We have reported on the mechanism of direct-bonding and ultralong life time of the irradiation effect [1],[2]. We report here that the direct-bonding effect disappears after treatment of some liquid reagents.

EXPERIMENTAL PROCESSES

The experimental sequence is shown in Fig.1. PET films were irradiated by CO_2 plasma. The irradiated films were immersed in various liquid reagents, then rinsed and dried in the atmosphere. Then the films were roll-laminated by pressing at 140℃, to be bonded. Bonding strength was measured on the bonded films by 180° peel test. The film surface was analyzed by XPS.

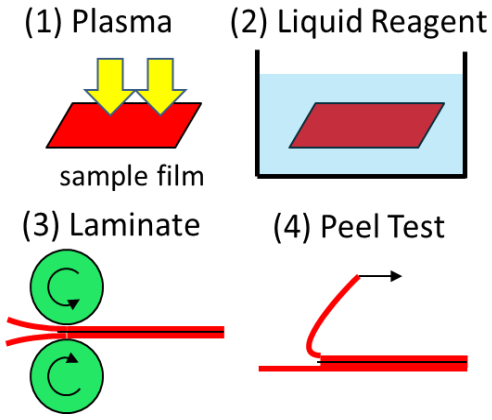

Fig. 1. Experimental sequence

RESULTS and DISCUSSION

The irradiated films can be bonded after immersing in pure water and hydrochloric acid. But they cannot be bonded after immersing in ferric chloride solution containing Fe ions. According to XPS, O/C atomic ratio of non-irradiated PET is 0.339, while it increases to 0.397 after the irradiation. However it decreases to 0.371 after immersing in the Fe-ion solution. The bonding effect disappears because the irradiation-created functional groups (-OH and -COOH) are consumed by reaction with Fe ions. This result and discussion support our proposal for the mechanism of bonding, that is, “Dehydration Condensation Reaction” under the thermal press.

REFERENCES

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