Modification of polymer surfaces by remote plasma

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Radicals being present in plasma were isolated and interacted with polymers in order to modify their surfaces because the modification reaction mainly proceeded in radical reactions. Polymer samples were positioned far from plasma zone, and were dominantly interacted with radicals. This technique is called remote plasma treatment. Modification by the remote plasma treatment was compared with that by conventional plasma treatment.

Kinetics of the remote plasma showed that the remote plasma treatment could enhance radical reaction. Hydrogen-substitution of polytetrafluoroethylene (PTFE) films by the remote hydrogen-plasma treatment, chlorination of polyethylene (PE) and polypropylene (PP) films by the remote carbontetracholoride (CCl_4)-plasma treatment, and decarbonization of plasma polymer films prepared from organic silicon compounds such as tetramethylsilane (TMS), dimethyldimethoxysilane (DMDMOS), and tetramethoxysilane (TMOS) by the remote oxygen-plasma treatment were carried out. The hydrogen-substitution reactivity was 91% which was higher than that (74%) by the conventional hydrogen-plasma treatment. The chlorination reactivity of PE and PP films surfaces was 32-79% which was higher than that (15-35%) by the conventional CC_4-plasma treatment. The carbon contents in the plasma polymer films decreased by the remote oxygen-plasma irradiation: the decrease were 68% in TMS, 55% in DMDMOS, and 38% in TMOS.

These experimental results showed that the remote plasma treatment was a good way to modify polymer surfaces.