PREPARATION AND PROPERTIES OF PHOTOSENSITIVE POLYIMIDES CONTAINING CYCLOBUTANE GROUPS

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Positive type of photosensitive polyimides is developed by irradiating maleimide cyclobutane dimer with 254 nm UV light leading to original maleimide derivatives by cycloreversion process. Photosensitive polyimides were synthesized from cyclobutane-1,2,3,4-tetracarboxylic dianhydride (CTP) and various properties of the polymers were investigated.

The polyimides with cyclobutane groups were prepared by thermal imidation of polyamic acids which were synthesized by the reaction of CTP with diamines. DSC analyses show that the decomposition of the polyimides takes place in the range 390 - 460 °C, which shows relatively high stability. These polyimides were not soluble in any organic solvents before the irradiation with 254 nm UV, but they become soluble in tetrahydrofuran or dimethylacetamide after irradiation. Not only photosplitting of cyclobutane ring but also photooxidation of C-N bond are considered to be the major photodegradation process for these polyimides.

The polyimides containing fluorine and cyclobutane groups were prepared by thermal imidation of polyamic acids which were synthesized by the reaction of CTP with aromatic diamines having hexafluoroisopropylidene group. The fluorinated polyimides are fairly soluble in polar aprotic solvents such as dimethylacetamide or N-methylpyrrolidone (NMP) unlike known polyimides. Intrinsic viscosities measured in NMP lies in the range of 0.4 - 0.6 dL/g. DSC analyses show that the polyimides begin to decompose at the temperatures range of 400 - 435 °C. The polyimides are not soluble in acetone or THF before the irradiation, but they become soluble after the irradiation.

The polyimides containing cyclobutane groups were used for the preparation of ultra thin film by the Langmuir-Blodgett method. The polyamic acid was treated with N,N-dimethyl-*n*-octadecylamine and it was deposited on silicon wafer. The deposited polyamic acid was imidized by chemical method. The thickness of the LB film was measured by ellipsometry. The pattern of submicron dimension has successfully formed on LB film of 8 nm thickness and shows good contrast. (This research is supported by the grants from Korea Science and Engineering Foundation)