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Chemically Amplified Photosensitive Polyimide Based on Norbornene End-Capped Poly(amic acid ethoxymethylester)

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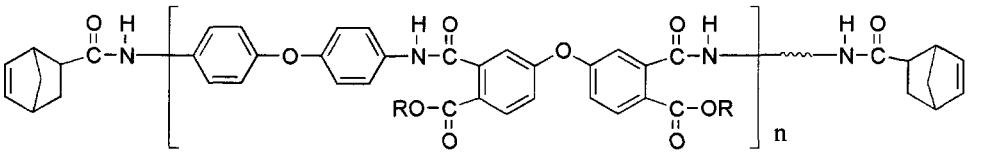
A positive-working chemically amplified photosensitive polyimide developable with basic aqueous solutions was obtained from poly(amic acid ethoxymethylester) (PAAE) as a polyimide precursor and diphenyliodonium 5-hydroxynaphthalene-1-sulfonate (DINS) as a photo acid generator.[1] The norbornene end-capped PAAE based on 4,4'-oxydiphthalic anhydride (ODPA) and 4,4'-oxydianiline (ODA) exhibits high transparency at 365 nm. The inherent viscosity and number average molecular weight of PAAE was effectively decreased with increases in the mole ratio of NDA because of the increasing stoichiometric imbalance between the dianhydride (ODPA) and the diamine (ODA). Although the molecular weight of PAAE was found to be reduced by higher NDA content, PI films imidized from this precursor retained good mechanical and thermal properties.[2]

The protection ratio of the ethoxymethyl groups was optimized to maximize the difference between the dissolution rates of the exposed and unexposed areas. The acid generated from DINS in the UV exposed region effectively deprotects the ethoxymethyl groups of PAAE by a chemical amplification mechanism. It was found that a 10 μm thick film of the PSPI precursor system containing 16 wt % DINS exhibits a sensitivity (D^0) of 1,100 mJ cm^{-2} when developed with 2.38 wt % aqueous tetramethyl ammonium hydroxide solution at room temperature. A fine positive 5 μm line and space pattern was fabricated in a 15 μm thick film with 1,500 mJ cm^{-2} of UV exposure. This resolution is excellent compared to those previously reported for chemically amplified PSPIs, and such a film can thus be used as a buffer coating in semiconductor packaging.



R = H or $CH_2OC_2H_5$

Figure 1. The structure of norbornene end-capped poly(amic ethoxymethylester).

References

1. Jung, M. S.; Seo, S. J., U.S. Patent 6,541,178, (2003).

2. Yang, S. Y.; Park, C. E.; Jung, M. S. *Polymer* **44**, 3243 (2003).