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Research Article

Photosensitive Benzoxazines Derived from Divanillidene Cyclopentanone/Cyclohexanone for Hydrophobic and Optical Applications

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Abstract

An attempt is made to synthesize two series of photosensitive benzoxazines using a divanillidene cyclopentanone/divanillidene cyclohexanone (DVCP/DVCH) core containing structurally different amines such as aniline, cyclohexylamine, 4-aminobenzonitrile, furfurylamine, and stearylamine with paraformaldehyde through Mannich condensation reaction. The molecular structure of the synthesized benzoxazines is confirmed from Fourier transform infrared and proton nuclear magnetic resonance ($^1\text{H-NMR}$) spectroscopic analyses. The curing behavior and thermal stability of the benzoxazines are analyzed using differential scanning calorimetry and thermogravimetric analysis, respectively. Both DVCP and DVCH core benzoxazines are cured by thermal and photocuring methods. Cyclopentanone core containing benzoxazines exhibit higher thermal stability when compared with that of most of the cyclohexanone core containing benzoxazines. The DVCP and DVCH core benzoxazines exhibit excellent hydrophobic behavior and good self-extinguishing properties. The photolysis of DVCP- and DVCH-based benzoxazines indicates that the α,β -unsaturated ketone moiety in the main chain dimerizes through $2\pi+2\pi$ cycloaddition reaction to form a cyclobutane derivative and leads to crosslinking. The photosensitivity of the benzoxazine decreases with an increase in the size of the cycloalkanone ring. The band gap energy (E_g) calculated from absorption spectra is found between 3.0 and 3.29 eV.

Conflict of Interest

The authors declare no conflict of interest.

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Data Availability Statement

The data that support the findings of this study are available in the supplementary material of this article.