Polymers for Advanced Technologies / Volume 35, Issue 12 / e70012

RESEARCH ARTICLE

Exploring the Potential of Bifunctional Polybenzoxazines Containing Schiff Bases for Superhydrophobic and Anticorrosion Properties: A Comprehensive Study on Synthesis and Characterization

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First published: 28 November 2024
https://doi.org/10.1002/pat.70012

Funding: The authors received no specific funding for this work.

ABSTRACT

Two series of bifunctional benzoxazines (HC-benz and HA-benz) containing Schiff bases (HC and HA) were synthesized through Mannich condensation. The structural confirmation of the Schiff base containing hydroxyl derivatives and benzoxazines was carried out using ATR-FTIR, HRMS, and ^{1}H-NMR spectroscopic techniques. The cure behavior and thermal stability were studied using DSC and TGA, respectively. Among the different benzoxazines studied, the HC-jfm and HA-jfm benzoxazines exhibited the lowest curing temperature of 216°C and 211°C, respectively. Both poly(HC-dde) and poly(HA-dde) showed higher char yield value of 41% at 850°C. The values of LOI and heat resistance index calculated from TGA data infer that these benzoxazines in particular poly(HC-dde) and poly(HA-dde) can be conveniently used for self-extinguishing and heat-resistant applications which was proved by achieving V0 rating during vertical flammability test. Results from EIS studies showed that poly(HC-jfm) and poly(HA-jfm) exhibited corrosion protection efficiency of 99.19% and 99.99%. The value of water contact angle results suggested that all the synthesized polybenzoxazines are hydrophobic in nature, whereas the poly(HC-ddm) and poly(HA-ddm) revealed the superhydrophobic behavior with values of 149^{o} and 159^{o}, respectively. The cotton fabric coated with polybenzoxazine exhibits excellent resistance to UV and chemicals. Data from different studies infer that these benzoxazines can be used in the form of coatings for thermally stable, anticorrosive, and superhydrophobic high-performance applications.

Conflicts of Interest

The authors declare no conflicts of interest.