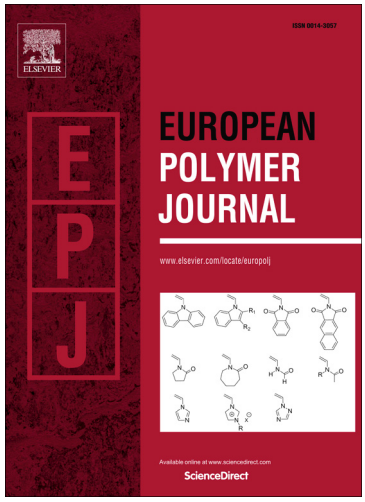

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Influence of the curing temperature on the diffusion rate of the perfluorinated alkyl chains of a modified epoxy resin

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Abstract

Perfluorononanoic acid (F17) was grafted to an epoxy resin. The virgin epoxy resin and the fluorinated epoxy resin were cured at various temperatures. Both air-resin and substrate-resin interfaces of the cured materials were characterized in terms of: (i) free surface energy, (ii) surface composition, evaluated using angle-resolved X-ray photoelectron spectroscopy (AR-XPS). Fluorine proportion was quantified at probing depths of about 4.5 and 9 nm. The curing temperature highly influenced the diffusion of the perfluorinated chains towards both interfaces. Depending on the curing conditions, very low free surface energies (17 mJ/m²) due to high fluorine concentrations (fluorine/carbon ratio = 0.6) were measured at the air-resin interface. However, the F17 diffusion towards the substrate was also observed and led to important fluorine concentrations (F/C up to 0.4). Finally, a two-step curing procedure was used for monitoring the F17 diffusion during the curing, illustrated by an accumulation of fluorine atoms at both interfaces. A non-linear relation was highlighted between the surface energy drop and the fluorine content measured by AR-XPS.

Keywords

Epoxy resin; Fluorinated additives; Surface properties; Diffusion rate; Angle-Resolved X-ray Photoelectron Spectroscopy.