Dynamic DSC curing kinetics and thermogravimetric study of epoxy resin of 9,9'-bis(4-hydroxyphenyl) anthrone-10

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ABSTRACT

Dynamic DSC curing kinetics of epoxy resin of 9,9'-bis(4-hydroxyphenyl) anthrone-10 (EAN) was carried out at 5°, 10°, 15° and 20°C min^{-1} heating rates in nitrogen atmosphere using 4,4'-diaminodiphenyl sulfone (DDS), 4,4'-diaminodiphenyl methane (DDM) and tetrahydrophthalic anhydride (THPA) hardeners. Peak exotherms shifted towards higher temperature range with increasing heating rate. DSC data were analyzed by Ozawa, Kissinger and Flynn-Wall-Ozawa methods to derive activation energy (Ea) and frequency factor (A). Observed trend in Ea and A is EAN-DDS > EAN > EAN-THPA > EAN-DDM. For EAN-amine systems both Ea and A decreased with increasing conversion and for EAN-THPA they increased up to 30% conversion and then decreased slowly with increasing conversion. Friedman plots showed autocatalytic nature of the EAN-hardener systems. Autocatalytic nature is due to dehydration of secondary alcohol groups with simultaneous formation of allylic double bonds. Thermogravimetric study at 10°C min-1 heating rate in nitrogen atmosphere revealed that cured resins (310°-337°C) are more thermally stable than thermally cured EAN (279°C) and followed either one or two step degradation kinetics.

key-words

Epoxy resin, Curing kinetics, Autocatalysis, Thermal stability, Kinetic parameters