TECHNOLOGY OFFER

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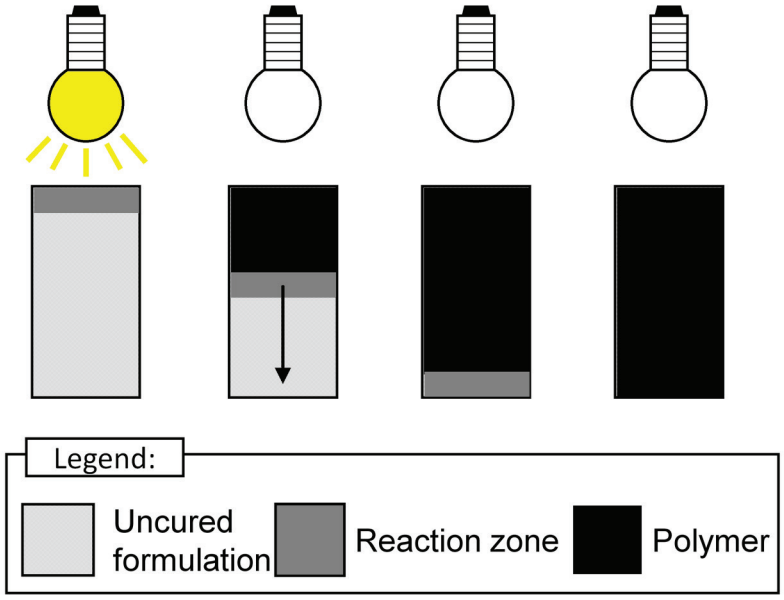
Novel method for curing of epoxy resins

BACKGROUND

Epoxy-based resins are nowadays used in numerous High Tech applications ranging from electrical insulation and stabilization in electrical engines and generators, aeronautic and nautical parts to chemical anchor bolts and repairing applications. Curing of bulk specimens is usually carried out by energy consuming heating of the whole part and therefore limits the applications to temperature insensitive materials. Limited pot life of such formulations containing amine- or anhydride-based catalysts is another disadvantage.
Frontal polymerization initiated by a stimulus of light or heat at the surface is a technique in which the polymerization heat is used for the cleavage of a thermal initiator which can reinitiate the polymerization reaction in adjacent regions. This effect leads to a moving localized reaction zone which is referred as reaction front (Figure).



TECHNOLOGY

The combination of frontal polymerization and radical induced cationic polymerization leads to a special technique called Radical Induced Cationic Frontal Polymerization (RICFP) which is especially convenient for the curing of low reactive epoxy resins like the diglycidylether of bisphenol A (BADGE). The benefits from the self-sustaining frontal polymerization reaction and the possibility to start the reaction contactless with light irradiation (or by local heating) are combined and allow bulk curing even of complex formed shapes with very little energy and time expense.

REFERENCE:
M008/2015

KEYWORDS:
- Epoxy resins
- Composites
- Bulk Curing
- Shadow Curing
- Frontal Polymerization
- Radical Induced Cationic Frontal Polymerization
- C-C labile thermal initiators

IPR:
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OPTIONS:
License agreement

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The newly developed system for RICFP consists of a so called C-C labile thermal initiator, a common onium-based cationic photoinitiator and a matrix based on bisphenol-A diglycidylether or any other epoxy resins like hexanedioldiglycidylether, cyclohexanedimethanoldiglycidylether or cyclohexanepoxide based systems.
The generation of the curing catalyst from the cationic photoinitiators is accomplished by irradiation with UV-light to start the polymerization. The thermal initiator is activated by the heat of polymerization. The formed radicals decompose the cationic initiator in regions which cannot be reached by UV-light leading to the frontal polymerization.
The described system has no negative impact of the classical thermomechanical and electrical properties of the materials, even improvements in some cases were observed. Also inorganic fillers display no problems for the curing mechanism.

BENEFITS

- Rapid curing
- High pot life of formulation
- Energy efficient
- Common and ubiquitous available components
- Low cost chemicals
- Works perfectly even with low reactive epoxy resins like BADGE
- Initiation possible with UV-light or local application of heat
- Works also for complex formed shapes

APPLICATIONS

- Chemical anchor bolts
- Automotive form parts
- Aeronautic and nautical parts
- Repairing applications
- Production of composite materials on epoxy base

FURTHER READING

Polym.Chem., 2015,6, 8161-8167
- Supplementary Information
- Supplementary MOVIE

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