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PII: S0079-6700(16)30035-1
DOI: http://dx.doi.org/doi:10.1016/j.progpolymsci.2016.06.003
Reference: JPPS 988

To appear in: *Progress in Polymer Science*

Received date: 11-8-2015
Revised date: 3-6-2016
Accepted date: 7-6-2016

Please cite this article as: Vidil T, Tournilhac F, Musso S, Robisson A, Leibler L, Control of reactions and network structures of epoxy thermosets, *Progress in Polymer Science* (2016), http://dx.doi.org/10.1016/j.progpolymsci.2016.06.003

Control of reactions and network structures of epoxy thermosets

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Abstract
Recent advances in macromolecular chemistry have revolutionized the way we perceive the synthesis of polymers. Polymerization, to be modern, must be "controlled", which usually means capable of producing macromolecules of well-defined structure. The purpose of this review is to examine how the chemistry of epoxy resins, an almost century-old chemistry, is also involved in this movement.
Epoxy resins are characterized by both the flexibility of implementation and the qualities of the polymers obtained. Key materials in health-, mobility- and energy related technologies, these resins are heavily present in high-performance composites, electronic boards, adhesives and coatings. Currently, a large number of resins and hardeners are available on the market or described in the literature and an interesting point is that almost any combination of the two is possible. Common to all these recipes and processes is that a liquid (or soluble) resin at some point becomes insoluble and solid. It is very important to know how to manage this transition, physically known as the gel point, as it is the point after which the shape of the object is irreversibly set. Taking into account the variety of epoxy polymerization processes — polyaddition, anionic or cationic polymerization— we detail a number of methods to program the occurrence of the gel point and how this type of control affects the structure of the growing network.

Keywords
Epoxy resins, Gelation, Latent curing agents, Thermo- and photo-generated initiators, Transfer agents

Abbreviations