

RADICAL INDUCED CATIONIC FRONTAL POLYMERIZATION OF EPOXY RESINS

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In the classic thermal bulk curing process huge parts with complex geometry can be cured. But to achieve reasonable curing times one has to deal with short potlife or elevated temperatures for accelerated polymerization speed. Photopolymerization on the other hand allows the usage of highly reactive formulations with long potlife. But since the necessary energy input to trigger the polymerization reaction is done via irradiation, only thin films and easy to illuminate geometries are cureable. Frontal polymerization is now a technique that unites the advantages of thermal bulk curing and modern photopolymerization. If this beneficial curing technique is now applied to cationic polymerization, even the, to this type of reaction intrinsic, advantage of oxygen insensitivity can be merged into a promising curing technique for e.g. epoxy resins.^[1, 2]

Therefore the liberated reaction heat of a light induced cationic ring opening polymerization of epoxides is used to cleave a radical thermal initiator. The generated radicals undergo now a redox reaction with the initiator of the cationic polymerization. Thereby an acid species is generated that induces the very same cationic ring opening polymerization the process started with. Thanks to this cyclic reaction cascade a self-sustaining reaction zone is formed, that moves through the epoxy resin until all monomer is cured (Figure 1). This curing technique offers not only new application possibilities for epoxy resins, but bears also the opportunity to improve established processes regarding curing time and energy consumption. Latest results regarding the thermomechanical properties and the borders of the radical induced cationic frontal polymerization will be presented.

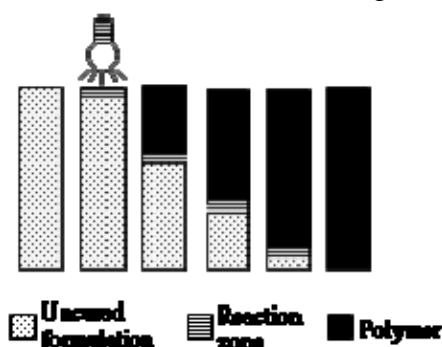


Figure 1: Scheme of a frontal polymerization

[1] D. Bomze, P. Knaack, R. Liska, *Successful radical induced cationic frontal polymerization of epoxy-based monomers by C-C labile compounds*, Polymer Chemistry 6(47) (2015) 8161 - 8167.

[2] D. Bomze, P. Knaack, T. Koch, H. Jin, R. Liska, *Radical induced cationic frontal polymerization as a versatile tool for epoxy curing and composite production*, J. Polym. Sci., Part A: Polym. Chem. 54(23) (2016) 3751-3759.