

New Onium Salts as Initiators for Cationic Polymerization, especially Radical Induced Cationic Frontal Polymerization

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Cationic polymerization is a powerful tool when it comes to adhesive, coating, composite and bulk material production. Suitable monomers for cationic polymerization range from unsaturated molecules like vinyl ethers, to heterolytic compounds such as epoxides. Epoxy-based systems are used in many applications, due to their high reactivity, versatility and mechanical properties. However, most epoxy resins are still cured by the addition of anhydride- or amine-based hardeners, which takes a lot of time and energy to fully cure. With the introduction of radical induced cationic frontal polymerization (RICFP), a much more energy efficient and fast pathway to cure epoxides and with it, a variety of new applications were obtained.¹ The prevailing initiator class for RICFP applications are iodonium salts, which can be cleaved by light as well as suitable radicals.² A lot of research and fine-tuning of the formulations and a lot of research lead to a highly effective and versatile initiator system.

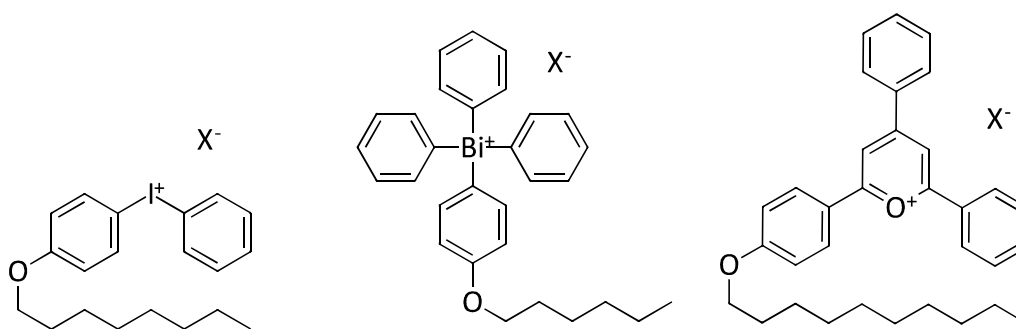


Figure 1: General structures of alkoxyated iodonium-, bismuthonium- and pyrylium-salts

With the introduction of bismuthonium- and pyrylium-based salts for frontal polymerization, the well-known iodonium salt is challenged (**Figure 1**). Bismuthonium hexafluoro-antimonates show fast frontal velocities of 6.2 cm min^{-1} , a high polymerization rate and conversions of 84% in an epoxy system.³ Bismuthonium-based systems show excellent pot life of the epoxy-formulations, which can be cured at the press of a button. Bismuthonium initiator-based formulations lasts over one month with no significant drop in reactivity or frontal velocity. Additionally, the influence of the counterion X^- is presented as well.

Keywords: Epoxides, Cationic Polymerization, Onium Salts, Iodonium Salts, Photoacid Generators

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