



Ionic Liquids in Polymer Chemistry

Due to their unique physical and chemical properties, ionic liquids have several possible applications in polymer chemistry. The three most interesting and most promising of which are highlighted herein:

1. ILs as solvent for polymerisation reactions

Even though research concerning polymerisation in ionic liquids is still at an early stage, ionic liquids have already brought a number of benefits to polymer synthesis. For instance, **free radical polymerisation** proceeds at a much higher rate and there is evidence that both the rate of propagation and the rate of termination are effected. Whole polymerisation types have yet to be investigated in ionic liquids, such as **ring opening polymerisation** to esters and amides or **condensation polymerisations** of any type.^[1]

2. ILs as conductive ingredients in polymer gels

The development of novel highly ion-conducting and proton conducting polymer electrolytes in particular for potential applications in a wide variety of solid state electrochemical devices, e.g. **PEM fuel cells**, has received an outstanding interest. This is driven by the intrinsic properties of the polymer electrolytes, such as **thin-film forming ability**, **flexibility**, and **transparency** as well as the relatively **high ionic conductivity** and **wide electrochemical window**. Due to their immeasurably **low vapor pressure**, **high thermal and electrochemical stability**, ionic liquids are considered to be **suitable electrolyte salts for polymer-in-salt systems**, since they meet all the requirements of plasticizing salts. They offer the potential for improved thermal and mechanical properties and thus may expand the temperature range where flexible polymers can be used.^[2]

3. Functionalised ILs as components for copolymers

As detailed in section 2, the introduction of ionic components allows for a systematic alteration of structure and properties of polymer materials. However, if the ionic component is only immobilised by comparably weak intermolecular interactions, the composition of such materials may change on a long-term time scale. Therefore, for some systems, it is better to link the ionic liquid to the polymer backbone via suitable functionalities, e.g. vinyl groups.^[3-5]

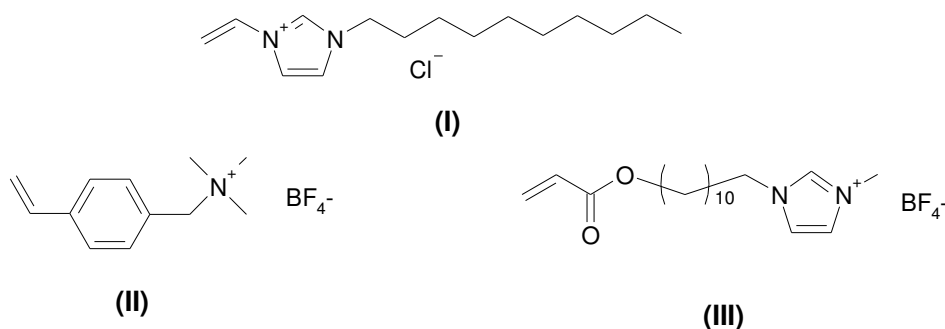


Fig. 1. Examples for Ionic Liquids suitable as monomers for polymerisation (1-decyl-3-vinylimidazolium chloride (I),^[3] *p*-vinylbenzyltrimethylammonium tetrafluoroborate^[4] and 1-(2-acryloyloxyundecyl)-3-methylimidazolium tetrafluoroborate^[5]).

Most ionic liquids that are suitable as components in polymers have comparably specific demands and therefore often called "**task specific ionic liquids**". If you are interested in special ionic liquids for polymerisation, please do not hesitate to contact us.

References:

- [1] P. Wasserscheid, T. Welton (Eds.), *Ionic Liquids in synthesis*, Wiley-VCH 1st ed. **2003**.
- [2] Md. A. Bin Hasan Susan, T. Kaneko, A. Noda, M. Watanabe *J. Am. Chem. Soc.* **2005**, *127*, 4976.
- [3] D. Batra, S. Seifert, L. M. Varela, A. C. Y. Liu, M. A. Firestone, *Adv. Funct. Mater.* **2007**, *17*, 1279.
- [4] A. Blasig, J. Tang, X. Hu, Y. Shen, M. Radosz, *Fluid Phase Equilibria* **2007**, *256*, 75.
- [5] F. Yan, J. Texter, *Angew. Chem.* **2007**, *119*, 2492.

