Novel ILs with Alkoxyaluminate and Alkoxyborate Anions: $[M^{III}(OCH(CF_3)_2)_4]^-$ (M = Al, B) Synthesis, Characterisation and Physical Properties

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In recent years ionic liquids (ILs) aroused large interest due to their interesting physical properties leading to potential use in a wide range of applications. Low melting salts such as room temperature ionic liquids are more interesting for many applications. In general one can expect that weaker anion-cation interactions lead to lower melting salts with lower viscosities and higher conductivities.[1] Weakly coordinating anions (WCA's) are good candidates for the synthesis of new salts with lower melting points and optimized other physical properties.

ILs with Alkoxyaluminate Anion and their Physical Properties

It is well-known that $[Al(OCH(CF_3)_2)_4]^-$ is a symmetrical and weakly coordinating anion which is used since 1999 in our group for example to stabilize reactive cations.[2] Since the lithium salt of the anion melts at 120°C, by changing of Li^+ for a weakly coordinating cation one can obtain low melting salts as first explored by A. Mudring et al. for two ILs with this anion-type.[3] We could synthesise[4] in the last years a series of ILs with this anion and study their physical properties.

Some of these ILs are liquid even at the room temperature. In addition to low melting temperatures they offer some other interesting properties such as low viscosities (down to 38 cP), high conductivities, good electrochemical stabilities and good hydrogen solubilities. The polarities of these salts were also investigated within the measurements of the dielectric constants (DC's). The measured statistic dielectric constants were much higher as expected. To understand this phenomenon NMR investigations and DFT calculations were carried out. Investigation in context of Walden rule was also made.

ILs with Alkoxyborate Anion, $[B(OCH(CF_3)_2)_4]^-$

A disadvantage of the aluminate anion is its water sensitivity. Now the synthesis of a homologous anion with boron as central atom succeeded, which stable in water, because B—O bonds are shorter and less non-polar than Al—O bonds. As expected, the salts of this anion melt at low temperatures and offer good physical properties.

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