SYSTEMATIC STUDY OF THE DYNAMIC AND STATIC THERMAL STABILITY OF IONIC LIQUIDS

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Background: Dynamic thermal stabilities reported for ionic liquids are typically much greater than the static counterparts. Thus, most ionic liquids are not stable for long periods of time at, or even well below, the onset of decomposition temperature, T_d, usually measured by thermogravimetric analysis (TGA). Scott *et al.*[1,2] have shown that the use of heating ramps in the TGA to estimate the high temperature stability of ionic liquids can be misleading, as it leads to values of apparent decomposition temperatures which are much higher than those measured in isothermal studies.

Experimental: The current study is focused on static thermal data over 24 hour periods at different temperatures and dynamic thermal data with multi-temperature heating rates from 0.5 to 10 ºC/min. Thermogravimetric analysis (TGA) was conducted with a TA Instruments TGA Q50 under a nitrogen atmosphere with hermetic aluminium pans with a pinhole in the temperature interval from 60 to 600 °C.

Discussion: To properly characterize the thermal stability of ionic liquids and thereby justify their proposition as solvents with high thermal stability, we present a series of thermogravimetric measurements, both static and dynamic, that allow the determination of more realistic decomposition temperatures of different families of ionic liquids, namely those based on the cations 1-alkyl-3-methylimidazolium and trimethylethanolammonium with different anions. We also measured the effect of the alkyl chain length of the anion on the thermal stability of ionic liquids through the use of the alkylsulfonate anion.

Conclusions: This work shows that the decomposition temperatures usually reported in literature using fast-scan TGA are over-estimated, in some cases by more than 100 ºC. From the experimental results it is possible to conclude that the anion has a large influence on the thermal stability of ionic liquids.

References:

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