Exploring the Catalytic Behaviour of Indium Ionic Liquids for Sustainable Alkylation

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Despite the industrial desire for more sustainable routes to alkylated aromatics, their synthesis still uses an excess of highly toxic, environmentally damaging, single-use acid catalysts such as H_2SO_4 and BF_3. Halometallate ionic liquids (ILs), specifically indium based ILs have been found to be a promising alternative for these traditional acid catalysts, however current speciation knowledge,[1] is insufficient to explain the observed catalytic Lewis acidity of them. We therefore investigated the speciation and chemical properties of a series of indium ILs (Figure 1), probing the oxidation state and bonding of indium (XPS and XAS), quantifying the Lewis acidity (Gutmann Acceptor Numbers), and exploring ligand-catalyst interactions through varying the coordination strength of the ligands.

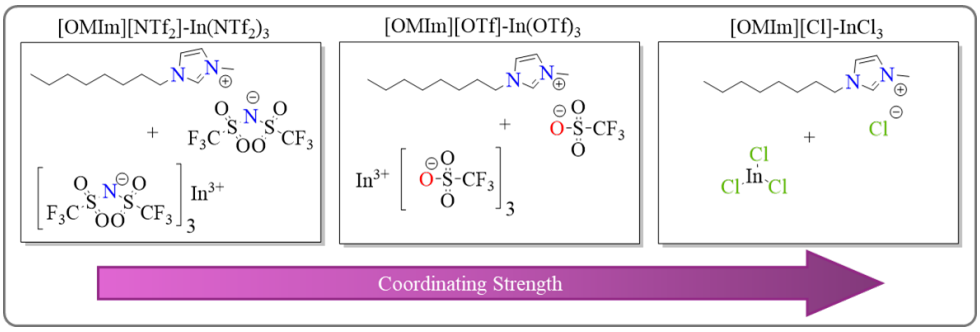

Figure 1: Indium ILs investigated in study.

The identification of the active catalytic species, and the structural and mechanistic insights observed, have allowed us to link the speciation of the ILs to their chemical properties. This will enable the design of new ILs with optimized catalytic performance, lower costs, and greener profiles in future work. These more efficient ILs will help us to replace existing catalysts, lowering the environmental impact and risk of synthesising alkylated aromatics, produced globally on a 100 million tonne scale.[2]

References

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Currently a 4th year PhD student in the Licence Research Group at the University of Nottingham, working in collaboration with Lubrizol and the University of Warwick as a part of the EPSRC Prosperity Partnership. PhD project focuses on the functionalization of alkenes, utilising ionic liquid catalysts. Obtained an MSci (Hons) Chemistry with a Year in Industry (1st) from the University of Nottingham in 2021. Presented posters at the ACS 27th Annual Green Chemistry & Engineering Conference (2023), and at the Emerald Isle Conference of Sustainable Chemistry & Engineering (2025). Twice awarded beamtime for B18 at Diamond Light Source (2024 and 2025).