

Excellent selectivity control with mono- and bifunctional ionic liquid coatings in SCILL catalysts for selective hydrogenation reactions

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Solid Catalyst with Ionic Liquid Layer (SCILL) systems offer a large advantage over classical unselective heterogeneous catalysts. By coating the catalysts with ionic liquids (ILs) it is possible to achieve higher selectivities by altering the reactivity of sites that otherwise would lead to unwanted reactions (red in Figure 1).

While SCILL systems have attracted increasing attention in the past, functionalized ionic liquids (ILs) have hardly been used in this field so far. We coated a commercial Pd/Al₂O₃ catalyst with a variety of functionalized ILs and tested its performance in the selective removal of acetylene in ethylene-rich feeds.

While a sulfonic-acid-functionalized IL coating led to an active but unselective catalyst, a catalyst coated with a nitrile-functionalized IL reduced selectively the acetylene concentration down to below 1 ppm. The performance could be maintained even when diluting the functionalized with an unfunctionalized IL. We also conducted long-term stability experiments and examined the potential transformations of the IL layer under reaction conditions using ¹H NMR. Most tested ILs either remained unaltered or underwent C2-ethylation, while the IL's functionalities appeared to be stable. Our findings highlight the great potential of functionalized ILs in modifying heterogeneous hydrogenation catalysts.[1]

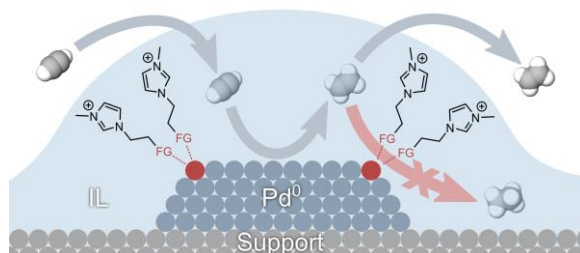


Figure 1: Systematic representation of the coordinative SCILL effect: The IL can selectively interact with specific catalytic sites and reduce unwanted reactions, here the overhydrogenation of acetylene to ethane.

[1] D. Kremitzl *et al.*, *J. Ionic Liq.*, 2024, **4**, 100092, doi.org/10.1016/j.jil.2024.100092.