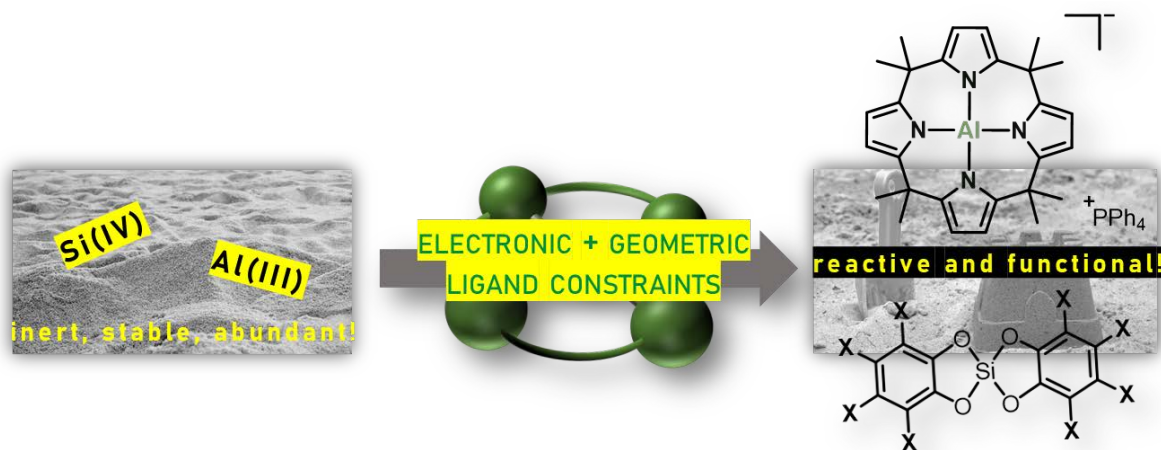


Ligand control on aluminum(III) and silicon(IV) – pushing the abundant elements away from their thermodynamic sink

Lutz Greb, University Heidelberg, Germany

Silicon and aluminum are the second and third most abundant elements in the earth crust. In their oxide minerals, (alumo)silicates, they possess substantial thermodynamic stability. However, to use compounds based on silicon or aluminum as reactive reagents or catalysts, they have to be pushed out of their thermodynamic comfort zones. Usually, this is achieved by changes in oxidation states – e.g., Si(IV) → Si(II) – or by unusual valence states (e.g. silylium ions). In contrast, we aim for enhanced reactivity by a ligand-based perspective, but without leaving their stable oxidation states. Strong geometrical deformation of tetrahedral coordination spheres or strong electron withdrawal on silicon(IV) or aluminum(III) is applied. By doing so, we developed the first planar tetracoordinate aluminum anion, which can undergo ligand-element cooperative bond activation reactions and perform new modes of catalytic transformations. Moreover, very electron poor catechol-type of ligands empower neutral silicon compounds with the rewarding feature of Lewis superacidity.



At first – and in particular from the perspective of *industrial inorganic chemistry* – our interests might appear as rather fundamental. However, it enables mild reaction pathways that will allow maintaining reversibility, vital for every catalytic process. Thus, it aims to provide an alternative for the rare transition metal elements so prominent in catalysts – now based on the most abundant elements in the earth crust.