From Ionic Liquids to nanostructured Ionic Solids: Ionosilicas as 'Designer Materials'

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Ionosilicas, defined as silica based materials containing covalently anchored ionic groups, recently emerged as a new family of functional organosilicas. Ionosilicas are synthesized via sol-gel reactions starting from ionic precursors [1], and combine the characteristics of mesoporous silicas (porosity, regular architecture on the mesoscopic scale) with an unmatched chemical versatility of the incorporated ionic sites. Our special concern is to design purely ionic-inorganic hybrid materials (Figure 1) *via* hydrolysis-polycondensation reactions exclusively from silylated ionic precursors. These materials display highly adaptable interfacial properties due to an incalculable number of possible anion-cation combinations. Ionosilicas can therefore be considered as '*heterogenized Ionic Liquid phases'*. Furthermore, the high density of ionic groups, confined in a reduced space, provides a very special chemical environment and gives rise to unusual confinement effects, which cannot be achieved in conventional 'molecular' porous materials.

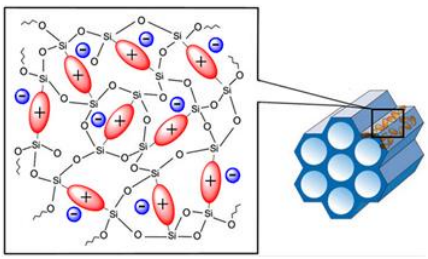

Figure 1. Schematic representation of an ionosilica

This talk will highlight the extraordinary polyvalence of ionosilicas. On the one side, we can control the textural and morphological characteristics of these materials from the molecular level to the macroscopic length scale by the choice of the reaction conditions [2]. In this way, ionosilicas displaying various shapes such as monoliths, electrospun fibers and porous nanoparticles can be accessed. On the other side, the chemical and morphological polyvalence of ionosilicas broadens the potential of these materials for various applications. Ionosilicas are highly efficient anion exchange materials with great potential in areas as different as adsorption [3], biomedical applications [4, 5] or organocatalysis [6]. Finally, ionosilicas' syntheses can easily be up-scaled to a kilogram scale. Ionosilicas are therefore not laboratory curiosities but highly versatile and adaptable functional materials.

REFERENCES

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