
Structural Organization in Amorphous Silico-Aluminas

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Abstract: A structure model for amorphous hydrated or dehydrated silico-aluminas with composition varying between $0 < \text{Al} : \text{Al} + \text{Si} < 1$ is presented. A central core made from a tetrahedral network in which silicon is partially substituted by aluminium carries a net negative electrical charge. This charge is balanced by more or less polymerized hydroxyaluminium cations forming a coating around the core.

As $\text{Al} : \text{Al} + \text{Si}$ increases, the number of substitutions in the core increases as well as the complexity of the hydroxyaluminium cations in the coating.

For $\text{Al} : \text{Al} + \text{Si} \gtrsim 0.8$, a demixing is observed, leading to the formation of a crystalline pseudoboehmite and bayerite.

Upon heating, the coating as well as the demixed phases are transformed into a spinel structure containing tetrahedral aluminium, while the core structure remains unaffected.

This model could explain the solubility features, the phosphate reaction and the catalytic properties of amorphous silico-aluminas.

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