Physicochemical Properties of Bayer Liquors: A Comprehensive Model

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Realistic simulations of the Bayer process for alumina production are a prerequisite for innovative process design and optimization. A comprehensive Pitzer model has been developed to represent the thermodynamic properties of synthetic Bayer liquor solutions, consisting of ten components, i.e. water plus sodium hydroxide, aluminate, carbonate, sulfate, chloride, fluoride, oxalate, formate and acetate. The model calculates, in a thermodynamically consistent manner, heat capacities, enthalpies, activity and osmotic coefficients, vapor pressures, boiling point elevations and densities of these solutions as well as the solubilities of gibbsite, boehmite, sodium oxalate, and other relevant solid phases in synthetic Bayer liquors over the concentration and temperature ranges of industrial interest. Applications of the model to predict the properties of actual plant liquors will be presented.