

Prenucleation clusters, phase separation, and amorphous precursors: Some thoughts on linking carbonates, zeolites, and silicate melts and glasses

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Despite vigorous discussion of “prenucleation clusters” (PNC), especially in carbonate systems, the concept remains somewhat ill-defined. Questions one might ask include the following; How large and long lived must a complex ionic species in solution be to be called a PNC? How large must a complex cluster be for the concept of “surface energy” or “interface energy” to apply? How sharp must the boundary between a PNC and the solution be? When is a PNC an indicator of incipient phase separation into solvent-rich and solvent-poor phases? Must a PNC have structure representative of the precipitating phase? This talk will address these questions from three different vantage points: the transformation from aqueous solutions to amorphous precipitates in hydrated carbonate and phosphate and silicate systems, zeolite synthesis involving organic structure directing agents, and phase separation and crystallization in high temperature silicate and borate glasses and melts.