Amorphous transitions: Metasomatic changes that drive glass corrosion performance

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The corrosion of glass can be simply stated as a transition from a relatively high-energy amorphous state into a lower thermodynamic state. This can occur through simple dissolution, with glass ions more thermodynamically favored in solution. Very rarely, a direct transition to a lower-energy crystalline phase can occur. Most of the time, however, multicomponent silicate glasses transition into different amorphous phases: an alteration gel, an altered portion of the original structure, or a series of solid-solution amorphous silicates. This transition is not well accounted for in test results, in experiment interpretation, or in the modeling of the processes of corrosion. This talk will examine these transitions in natural and manmade silicate glasses and their role in predictable aqueous corrosion. In particular, the mechanism of morphological evolution will be explored as a means to account for the dynamic structures and solution responses seen in the study of glass corrosion. Mathematical fits to various long-term corrosion datasets are also presented.