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'Crystal genes' in metallic liquids and glasses

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It has been widely speculated that dominant motifs, such as short-range icosahedral order can influence glass formation. Less well understood is how these motifs (crystal genes) in the liquid can influence phase selection upon devitrification. These 'crystal genes' are the underlying structural order that transcends liquid, glass and crystalline states. By comparing the amorphous states of the same alloy compositions formed by sputtering and rapid solidification, and their devitrification pathways, we can quantify the distribution of the common packing motifs in the liquid or glass and in stable and metastable phases which form. We will discuss how this approach brings new insight into the origin of vitrification and mesoscopic order-disorder transitions in condensed matter. A genetic algorithm is applied to search for the energetically favorable stable and metastable crystal structures of complex metallic compounds, and a cluster alignment method reveals the most common packing motifs in crystalline and non-crystalline structures.

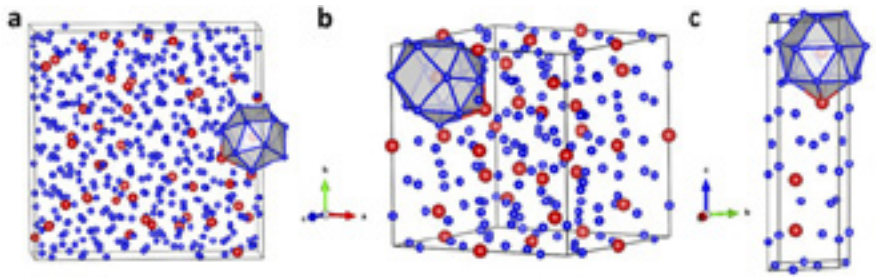

Fig. The commonly shared "3661" motif in AlSm glass and devitrified metastable crystal structures.

Biography

Feng Zhang is an Assistant Scientist III at the Ames Laboratory, US DOE. He received his Ph.D. in physics from Penn State University in 2008, and held a postdoctoral fellow position at Georgia Institute of Technology before joining Ames Lab. His current research interest lies in the structure and dynamics of metallic liquids and glasses, and phase selection during transformations into crystalline structures.

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