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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 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.

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