Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Crystal gene: Common motifs transcending crystals, glasses, and liquids FENG ZHANG, YANG SUN, ZHUO YE, YUE ZHANG, Ames Laboratory of US Department of Energy, XIAOWEI FANG, ZEJUN DING, University of Science and Technology of China, CAI-ZHUANG WANG, MIKHAIL MENDELEV, RYAN OTT, MATTHEW KRAMER, KAI-MING HO, Ames Laboratory of US Department of Energy — We establish through typical metallic systems Cu-Zr and Al-Sm the concept of "crystal gene", that is, structural order in the short-to-medium range order that transcends crystals, liquids, and glasses. With such a connection between crystalline and amorphous phases, a mature toolset for treating crystals can be used to assist the identification of complicated structural order in amorphous systems, which is a fundamental difficulty in physics and materials science. In addition, as demonstrated in the example of the $Al_{90}Sm_{10}$ system, the crystal gene persists from liquid to crystalline phases during the crystallization processes observed in experiments. Therefore, the identification and quantification of the crystal gene bring new insight into the atomistic transformation mechanism from the amorphous to various metastable crystalline phases, which can ultimately lead to a better understanding of phase selection in metallic alloys.

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Date submitted: 12 Nov 2016 Electronic form version 1.4