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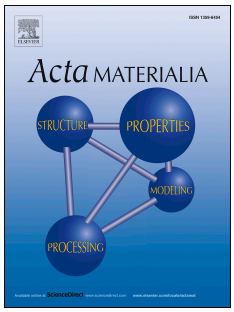

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Correlating Defects Density in Metallic Glasses with the Distribution of Inherent Structures in Potential Energy Landscape

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Abstract:

The structural evolutions of potential energy landscape (PEL) are investigated in a metallic glass modeling system with different cooling histories spanning more than five orders of magnitude. The local minima in the PEL are observed to be spatially more separated in the samples with lower fictive temperature T_{fic} than in the samples with higher T_{fic}. An Arrhenius scaling between the local minima density and T_{fic} is observed, which directly links the distribution of inherent structures in the PEL to the population of shear transformation zones (STZ) in amorphous solids. Moreover, very interestingly, the Arrhenius scaling breaks at 1.3~1.4 T_g, above which an invariant PEL structure with a saturated density of local minima is achieved. The hereby obtained critical temperature coincides with the experimentally observed dynamics crossover temperature, which suggests a profound connection between the PEL structure and dynamics in glassy system.