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Glass formation by first-order transition in Al-Fe-Si system
LEONID A. BENDERSKY, JOHN W. CAHN, Materials Science and Engineering Laboratory, NIST, Gaithersburg, MD 20899-8555, USA — There are two quite different views of metallic glasses. One, that a glass forms when an undercooled melt becomes kinetically frozen. This mechanism is quite universal and in principle occurs for all melts if they can be cooled rapidly enough. Usually such glasses tolerate wide compositional variations and occur at deep eutectics. The other view looks for efficient high-density low-energy packing of atoms in an aperiodic isotropic structure. These glasses, which we dubbed q-glasses, are expected to be less tolerant of composition variations and do not require deep eutectic. In our earlier publications we presented evidence of the existence of a q-glass in Al-Fe-Si. The glass was found to form from the melt as a primary phase by a nucleation and growth reaction before there is any crystallization was found to occur in. Here we present detailed study of formation of the Al-Fe-Si q-glass in a wide range of compositions. It was found that the glass behaves as a stoichiometric compound, with a concentration near 15 a/o Fe, 20 a/o Si. For other compositions formation of complex intermetallic compounds and an icosahedral phase were observed

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