THERMODYNAMICS OF GRAIN-BOUNDARY GLASS CRYSTALLIZATION

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ABSTRACT

Reasons why the thermodynamics of crystallization of a glass which is segregated to grain boundaries should differ from crystallization of bulk glass of the same composition are examined. The difference arises for two reasons: (a) the surface energy term in the equation for the change in free energy, in going from a glass to a crystalline state, is favourable to retaining the glass, if the dihedral angle formed between the crystal and the glass is less than $\pi/3$ (1); (b) when a crystal grows in a glass which is contained within a small crevice in a ceramic material, then the strain energy associated with crystal growth can become large which will reduce the driving force for crystallization (2). The strain energy arises because there is a volume change when glass crystallizes, and because the hydrostatic stress produced by the volume change cannot be released by fluid flow. It can in fact be shown that under most conditions the glass can be crystallized only partially.

REFERENCES

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