DTA studies on the crystallization of In\textsubscript{x}Se\textsubscript{1-x} chalcogenide glasses

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Abstract:

Results of differential thermal analysis (DTA) under nonisothermal conditions on five chalcogenide glasses of the In\textsubscript{x}Se\textsubscript{1-x} system (x = 0.05, 0.10, 0.15, 0.20 and 0.25 at.) are reported and discussed. The crystallization mechanism has been studied by using DTA, scanning electron microscopy (SEM) and X-ray diffraction. From the dependence of the glass transition temperature (T\textsubscript{g}), the onset crystallization temperature (T\textsubscript{c}) and the crystallization peak temperature (T\textsubscript{p}) on the heating rate (\alpha), the glass transition activation energy (E\textsubscript{t}) and the crystallization activation energy (E\textsubscript{c}) were derived. The calculated E\textsubscript{t} for In\textsubscript{x}Se\textsubscript{1-x} varied between 246 and 309 kJ/mol. The results indicate that bulk crystallization with two-dimensional growth occurs for these glasses. The average activation energy of crystallization for In\textsubscript{x}Se\textsubscript{1-x} varied between 105 and 125 kJ/mol. In\textsubscript{0.10}Se\textsubscript{0.90} chalcogenide glass showed a minimum value of E\textsubscript{c} as well as (T\textsubscript{c} - T\textsubscript{g}), which represents the thermal stability of the glass, indicating that this composition has a tendency towards crystallization more than the other compositions.

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