# Conditions for the Formation of Glasses by Cooling Melts of One-Component Systems

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## Abstract

Well-known conditions for the formation of glass from the melt are sufficiently fast cooling rates and directed bonding between the constituents. These conditions, however, are not specific enough to select promising melts, which might form glasses upon cooling. Therefore, the phase transition from a solid to a melt and the accompanying flow and storage of enthalpy and entropy are considered in detail.

The melting entropy is stored in the new configuration of the constituents. Upon cooling a melt, this entropy cannot be removed by thermal conduction, but after it has been reloaded onto the vibrations of crystals. This reloading might be a bottleneck. The smaller the temperature interval where crystallisation is possible, the easier is glass formation. Extrapolating the enthalpy function from the molten state to lower temperatures, that temperature interval (relative to the melting temperature $T_m$ ) has been estimated to be $\Delta T_{min} / T_m = \Delta H_m /[T_m (2C_{pl} - C_{ps})] = \Delta S_m /(2C_{pl} - C_{ps}) \approx \Delta S_m / C_{pl}$ , wherein $\Delta H_m$ and $\Delta S_m$ are the molar melting enthalpy and entropy, respectively, and $C_{pl}$ and $C_{ps}$ are the molar specific heat capacities at constant pressure in the molten (index "*l*") and crystalline (index "s") states. In fact, $\Delta T_{min} / T_m$ is small for all known one-component systems forming glasses by cooling their melts, which seems to characterise their glass forming capability glasses quite well.