

# Application of a New Necessary Criterion for Glass Formation of One-Component Systems

Phys. Chem. Glasses **46** (6), 570-578 (2005)

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## Abstract

Necessary conditions for glass formation by cooling melts are the presence of directed bonds and a sufficiently small temperature interval below the melting temperature,  $T_m$ , in which the atoms or constituents can rearrange to form crystallites. The corresponding temperature interval relative to  $T_m$  is estimated to be  $\Delta T_{min} / T_m = \Delta S_m / (2C_{pl} - C_{ps})$  from the melting entropy,  $\Delta S_m$ , and the specific heat capacities in the molten and the solid state,  $C_{pl}$  and  $C_{ps}$ . This criterion has been applied to about 450 different one-component systems using literature data, comprising chemical elements, oxides, halides and chalcogenides as well as hard materials and intermetallics. The results are shown in detail and compared with information on the glass forming ability. Basically, new glass systems are not found beyond the vast empirical knowledge from the literature. However, the criteria help to understand the empirical results which systems form glasses and which do not. An important result for new developments is to focus on eutectics of components with low  $\Delta T_{min} / T_m$ . Thus, the necessary criterion of low  $\Delta T_{min} / T_m$  helps to avoid unsuccessful research. According to the present review of data, glasses apparently cannot be obtained easily from one-component melts among the investigated borides, carbides, nitrides and silicides as well as intermetallics.