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Entropy and entropy of mixing

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Abstract

Entropy as a function of temperature at constant volume, $S(T)$, can be determined by *integrating* the molar specific entropy capacity C_V / T (C_V: molar specific heat capacity at constant volume). As a second approach, $S(T)$ at constant volume can be determined by *differentiating* the free energy with respect to the temperature, T. Recently, it has been shown for a system obeying Boltzmann statistics that these mathematical approaches are equivalent to applying the formula of the *mixing entropy*, if the ground and excited states of the same sub-systems or elementary systems are considered as mixing objects or quantum components. This result considerably extends the applicability of the formula of the mixing entropy, which is derived in textbooks just for mixing real indifferent components.

In the present paper, it is shown that the formula of the mixing entropy can also be applied to calculate the entropy of Bose and Fermi systems. Thus, all entropy can be calculated and interpreted as mixing entropy of real components or quantum components. In reverse, the transitions between the ground and the excited states of any system can be explained as mixing processes. This interpretation is applied to the melting transition of chemically bonded solids and in particular to the glass transition whereby upon cooling the mixing entropy of the melt is (at least partly) frozen in the configuration. These results suggest a new interpretation of the glass transition and a new definition of structural glass.