



Contribution ID: 30

Type: **not specified**

Peculiar thermodynamics in an orientational glass

Tuesday, July 7, 2015 5:20 PM (15 minutes)

The measurements of heat capacity and thermal conductivity of the glass-like monoclinic and the stable orthorhombic phases of 2-adamantanone ($C_{10}H_{14}O$) have been carried out in temperature range 2 K - 300 K. The results of heat capacity determination for the both investigated phases are almost the same, whereas for thermal conductivity measurements substantial differences have been found. The analysis of the thermal conductivity is performed in terms of several phonon scattering processes contributing to the resistive relaxation. The glass-like monoclinic phase displays the typical behavior of the ordered crystalline phases, but the fully ordered orthorhombic phase resembles a very defective crystal with thermal conductivity one order of magnitude smaller than that for the monoclinic phase. The discussion focuses on the influence of the statistical intrinsic disorder concerning the site occupancy of an oxygen atom among three different sites within the monoclinic phase. The situation give rise to large-angle molecular jumps associated with time-average fluctuations of the molecular dipole on the thermal properties.

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Session Classification: Soft Matter and Glassformers