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Thermochemistry of the alkali feldspars: Calorimetric study of the entropy relations in the low albite–low microcline series

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Abstract

New heat capacity data obtained on 12 samples of the low albite–low microcline series are presented. They were measured by relaxation and differential scanning calorimetry between 5 and 773 K. Two series, differing in their starting materials, were investigated, both of which were prepared via molten salt and solid-solid ion-exchange techniques in previous studies. The heat capacity of both series deviates positively from the ideal behavior leading to positive excess vibrational entropies of mixing, which can be described by a Margules mixing model yielding $W^S_{AbOr} = 8.60$ and $W^S_{OrAb} = 9.28$ J/(mol·K). The heat capacity and the vibrational entropy obtained on these Al,Si ordered samples are compared with those described in the literature for disordered samples. The solvi of the Al,Si ordered and disordered alkali feldspar systems were calculated from the calorimetric data and compared to experimentally determined solvi. Large deviations are detected for the ordered system, whereas consistent results are found for the disordered system, provided Na,K clustering is taken into account.

Keywords: Low-temperature heat capacity, $NaAlSi_3O_8$, $KAlSi_3O_8$, enthalpy, mixing model, miscibility gap