

Fusion enthalpies for Ni₂SiO₄, Co₂SiO₄ and Mn₂SiO₄ olivines

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Calorimetry for fusion of Ni₂SiO₄, Co₂SiO₄ and Mn₂SiO₄ olivine was carried out to determine fusion enthalpy of those olivines with Setaram MHTC. Heat of fusion (dHT_m) for Mn₂SiO₄ was measured by DSC method as temperature was raised at a rate of 2 C/min. Differences of enthalpy of Co₂SiO₄ between 298K and T (T=1100-1500 C) was measured by drop method under using PtCo capsule. dHT_m for Co₂SiO₄ was determined from differences of enthalpy near fusion temperature. Drop experiments at 1500 C were also carried out for the system An₅₀Di₅₀-Ni₂SiO₄ (XNi₂SiO₄ = 0, 0.25, 0.50) under atmospheric condition using Pt capsule. dHT_m for Ni₂SiO₄ was calculated by differences between H for crystalline Ni₂SiO₄ and H for liquid XNi₂SiO₄ estimated by extrapolation at 1500 C and dC_p.

The determined dHT_m are 91.9(+3.5) for Mn₂SiO₄, 103(+21) for Co₂SiO₄ and 143(+41) for Ni₂SiO₄ (J/K-mol). Fusion entropy (dST_m) can be calculated from dHT_m and T_m. The dST_m for Mn₂SiO₄, Co₂SiO₄ and Ni₂SiO₄ are 56(+2.1) for Mn₂SiO₄, 61(+12.4) for Co₂SiO₄ and 74(+21) for Ni₂SiO₄ (J/K-mol), respectively.

Based on the comparisons of dST_m for X₂SiO₄ (X=Fe, Mg, Mn, Ni, Co), we found that dST_m increases with decreasing ionic radius for X. This indicates that orthosilicate liquid including smaller cation have large entropy.