

## **Natural sepiolite: Enthalpies of dehydration, dehydroxylation, and formation derived from thermochemical studies**

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### **ABSTRACT**

Sepiolite is widely used in various fields due to its unique colloidal-rheological and physicochemical properties. The first experimental thermochemical study of natural sepiolite  $\text{Mg}_8\text{Si}_{12}\text{O}_{30}(\text{OH})_4(\text{H}_2\text{O})_4 \cdot n\text{H}_2\text{O}$  from Akkermanovskoe field (Southern Ural, Russia) was performed utilizing the high-temperature heat-flux Tian-Calvet microcalorimeter. X-ray powder diffraction, thermal analysis, and FTIR spectroscopy methods were used to characterize sepiolite. Processes of dehydration, dehydroxylation, and various water types' removal enthalpies were studied using thermochemical methods. The values of  $\Delta_{\text{dehyd}}H^0(298.15 \text{ K})$  of adsorbed, zeolitic, and bound water calculated per 1 mol of released  $\text{H}_2\text{O}$ , were as follows:  $15 \pm 4$ ,  $28 \pm 8$ , and  $39 \pm 15$  kJ/mol, respectively. The enthalpy of dehydroxylation of sepiolite was found as  $145 \pm 14$  kJ/(mol  $\text{H}_2\text{O}$ ). Obtained data point at different binding strengths of water in the structure of sepiolite. The enthalpies of formation from the elements  $\Delta H_f^0(298.15 \text{ K})$  were derived by melt solution calorimetry for sepiolite with various content of different water types:  $-18773 \pm 28$  kJ/mol for  $\text{Mg}_8\text{Si}_{12}\text{O}_{30}(\text{OH})_4(\text{H}_2\text{O})_4 \cdot 4\text{H}_2\text{O}$  and  $-16426 \pm 21$  kJ/mol for  $\text{Mg}_8\text{Si}_{12}\text{O}_{30}(\text{OH})_4(\text{H}_2\text{O})_4$ .

**Keywords:** Sepiolite, thermochemistry, microcalorimetry, enthalpy of dehydration, enthalpy of dehydroxylation, enthalpy of formation