

Thermal stability and spectroscopic studies of zemkorite: A carbonate from the Venkatampalle kimberlite of southern India

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ABSTRACT

While characterizing the mineralogy of the kimberlite at Venkatampalle, Andhra Pradesh, India (Lat. 14° 56' 00" N, Long. 77° 22' 15" E), we found the second occurrence of zemkorite (Na,K)₂Ca(CO₃)₂, which was first reported in 1989 in the Udachnaya kimberlite in Siberia. We also report the first Fourier-transform infrared spectroscopic (FTIR), scanning electron microscopic, thermo-gravimetric, and high-temperature heat capacity measurements on this rare carbonate. Powder X-ray diffraction (XRD) patterns show 24 well-resolved diffraction lines, all of which can be indexed with a hexagonal cell with $a = 10.038(5) \text{ \AA}$ and $c = 12.726(5) \text{ \AA}$. The vibrational spectrum of zemkorite at room temperature exhibits 13 distinct absorption bands in the frequency range 2000 to 400 cm⁻¹. The IR bands of zemkorite indicate a structural similarity with shortite but are quite distinct from other alkali carbonates such as nyerereite, butschiiite, and fairchildite. The heat capacity of zemkorite has been measured up to 700 K by differential scanning calorimetric techniques. The temperature dependence of the heat capacity of zemkorite was fitted with the polynomial $C_p = 140.2 + 8.584 \times 10^{-2} T - 2.458 \times 10^{-6} T^2$. The upper thermal stability of zemkorite is ~700 K, which is similar to shortite. Zemkorite may have formed during the late stages of kimberlite genesis, possibly as a result of metasomatism or by the breakdown of metasomatic natrocarbonatitic minerals or glass that segregated on decompression melting in the upper mantle.