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High-temperature Raman spectroscopy of $K_2Ca(CO_3)_2$ bütschliite and $Na_2Ca_2(CO_3)_3$ shortite

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ABSTRACT

Raman spectra of $Na_2Ca_2(CO_3)_3$ shortite and $K_2Ca(CO_3)_2$ bütschliite were measured to 715 and 740 °C, respectively, under vacuum. The vibrational spectra demonstrate that shortite converts to nyerereite [$Na_2Ca(CO_3)_2$] and calcite at 535 °C. This assemblage remains stable up to ~700 °C, at which point nyerereite begins to decompose. Bütschliite converts to the isochemical phase fairchildite at 570 °C, which is stable to 665 °C, where it decomposes to an assemblage of K_2CO_3 and CaO. The variation of anharmonicity between different vibrational modes of each of the low-temperature phases is assessed, and these yield insights into inter-carbonate group couplings. Both fairchildite and nyerereite exhibit spectral features consistent with extensive disordering.

Keywords: Carbonate, high-temperature, Raman spectroscopy, carbonatite