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LETTER

High-pressure phase transitions in Ca-Mn carbonates $(Ca,Mn)CO_3$ studied by Raman spectroscopy

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ABSTRACT

The influence of Mn content on the stability of the high-pressure $CaCO_3$ phases $CaCO_3$-I, $CaCO_3$-II, and $CaCO_3$-III at 300 K has been investigated up to 40 mol% $MnCO_3$ using Raman spectroscopy recorded in situ with a diamond-anvil cell at pressures up to 14 GPa. Beyond about 5 mol% $MnCO_3$, there is a progressive linear upward shift in the pressure of the $CaCO_3$-I → $CaCO_3$-II and $CaCO_3$-II → $CaCO_3$-III transitions, and expansion of the field of the $CaCO_3$-II phase, with increase in $MnCO_3$ content. The shifts in transition pressure are 0.19 GPa/mol% for I → II and 0.26 GPa/mol% for II → III over the 5 to 40 mol% $MnCO_3$ composition interval, results fully consistent with elevation of transition pressure by the introduction of a smaller cation. However, minor and trace amounts of Mn appear to have a relatively insignificant influence on the pressure of these transitions.

Keywords: Calcite, rhodochrosite, solid solution, high pressure, Raman spectroscopy, diamond-anvil cell