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Thermal Transport Properties of Carbonates: The Pseudobinary System

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Trigonal carbonates belong to the most abundant minerals in the Earth' crust. Within the trigonal carbonates, the minerals calcite, magnesite, and dolomite represent a pseudobinary system. In a simplified way, the dolomite structure can be described as resembling the calcite structure but with magnesium ions substituted for calcium ions in every other cation layer. We'll present experimental results on the thermal diffusivity of trigonal carbonates, both, as a function of temperature and orientation. It will be shown how the transport properties of dolomite can be determined from the endmember diffusivities. In direction of the crystallographic c- axis the geometric mean describes the diffusivity of dolomite, according to a serial connection of calcite and magnesite layers. Perpendicular to the crystallographic c-axis the arithmetic mean describes the diffusivity of dolomite, representing a parallel connection of calcite and magnesite layers. This observation is in agreement with the layered structure of dolomite.

Furthermore, the influence of iron on thermal transport properties is investigated. Already 1 % iron in the structure leads to a 25 % lower thermal diffusivity in direction of the crystallographic c- axis compared to an iron free sample. The transport properties of the trigonal carbonates will be compared to orthorhombic carbonates, which show a lower thermal diffusivity than the trigonal one. This is explained by a) the lower symmetry and b) the higher mass of the cations in orthorhombic carbonates.