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Thermal infrared spectroscopy and modeling of experimentally shocked plagioclase feldspars

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ABSTRACT

Thermal infrared emission and reflectance spectra (250–1400 cm^{-1}; ~7–40 μm) of experimentally shocked albite- and anorthite-rich rocks (17–56 GPa) demonstrate that plagioclase feldspars exhibit characteristic degradations in spectral features with increasing pressure. New measurements of albite (Ab_{98}) presented here display major spectral absorptions between 1000–1250 cm^{-1} (8–10 μm) (due to Si-O antisymmetric stretch motions of the silica tetrahedra) and weaker absorptions between 350–700 cm^{-1} (14–29 μm) (due to Si-O-Si octahedral bending vibrations). Many of these features persist to higher pressures compared to similar features in measurements of shocked anorthite, consistent with previous thermal infrared absorption studies of shocked feldspars. A transparency feature at 855 cm^{-1} (11.7 μm) observed in powdered albite spectra also degrades with increasing pressure, similar to the 830 cm^{-1} (12.0 μm) transparency feature in spectra of powders of shocked anorthite. Linear deconvolution models demonstrate that combinations of common mineral and glass spectra can replicate the spectra of shocked anorthite relatively well until shock pressures of 20–25 GPa, above which model errors increase substantially, coincident with the onset of diaplectic glass formation. Albite deconvolutions exhibit higher errors overall but do not change significantly with pressure, likely because certain clay minerals selected by the model exhibit absorption features similar to those in highly shocked albite. The implication for deconvolution of thermal infrared spectra of planetary surfaces (or laboratory spectra of samples) is that the use of highly shocked anorthite spectra in end-member libraries could be helpful in identifying highly shocked calcic plagioclase feldspars.