

# CO<sub>2</sub> Ice in Cold Dense Dark Cloud Cores: Abundance versus Visual Extinction

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**Abstract.** Ice mantle composition in cold dense cores may trace their chemical and physical evolution. Here we present the results of Spitzer IRS observations of the ice absorption features within cold dense dark cloud cores as a function of the visual extinction across the cores. We used 2MASS stars with high extinction as targets located behind the cores. We observed several target stars, with  $A_v = 5$  to 50 mag, across each core. Our results for IC 5146 E & W suggest a clear correlation between the CO<sub>2</sub> absorption with increasing  $A_v$ . We find that CO<sub>2</sub> absorption begins to show up only in regions with  $A_v$  greater than about 18 mag. Our results suggest a threshold ( $A_v$ ) for the dust column density required for the CO<sub>2</sub> mantle formation and evolution. This threshold appears to be significantly higher than that for CO (5 - 11mag), and H<sub>2</sub>O (3.3mag) ices. Our CO<sub>2</sub> results are consistent with the depletion and catalysis of CO deep in the cores.

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