CARBON DIOXIDE CLUSTERS AND COPPER COMPLEXES FORMED IN ARGON MATRICES[a]

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Neutral and anionic clusters containing carbon monoxide and carbon dioxide molecules were observed in FTIR matrix isolation spectroscopy experiments following co-deposition of Cu^- and Ar^+ in argon matrices doped with moderate amounts (0.1-1%) of CO_2 and/or CO. Following deposition at 10 K with 0.5% CO_2, peaks for $CuCO_2^-$ and $Cu(CO_2)_2^-$ were observed, along with a small peak for CO_2^- and several bands assigned to neutral $(CO_2)_x$ clusters. Upon annealing to 20 K, a new peak appears at 1857 cm^{-1}, which is assigned to the $C_2O_4^-$ ion, based on previous work in neon matrices.[b] When CO is added as a dopant (0.5 %) to the matrix gas mix, formation of the anionic copper CO_2 complexes is suppressed, and neutral CO-CO_2 complexes are observed in the spectra, as are bands corresponding to $C_2O_3^-$, based on previous studies.[c] Interestingly, the copper carbonyl bands typically observed for equivalent deposition conditions in the absence of CO_2 are strongly suppressed in these spectra. The implication is that complexation with the CO_2 molecules, which are far more abundant in the matrix, inhibits the CO molecules from "finding" the Cu^- centers during the matrix formation process. (c.f. ISMS 2014 abstract #P616)

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[a]Funding support from NSF CAREER Award CHE-0955637 is gratefully acknowledged

[b]Zhou, M.F.; Andrews, L.; J. Chem. Phys. 110, 6820 (1999).

[c]Zhou, M.F.; et al., J. Chem. Phys. 112, 7089 (2000).