Electron-Induced Chemistry of $Co(CO)_3NO$

Ferromagnetic cobalt metal nanostructures are important for the development of, for example, Hall-Effect sensors, which can be found in automobiles, cell phones, computers and several other applications that involve microelectronics.[1] A promising technique for depositing metal nanostructures is the focused electron beam induced deposition (FEBID) of metal-organic precursors.[2,3] Common precursors investigated for the FEBID of cobalt metal are $Co_2(CO)_8$ and $Co(CO)_3NO$.[4–7] However, high organic content can be found within these deposited cobalt metal nanostructures, limiting the feasibility of FEBID for depositing high-purity cobalt metal.

Recently, Postler et. al. have investigated the FEBID of $Co(CO)_3NO$ in attempt to further understand its dissociative electron attachment (DEA) mechanism.[4] Specifically, $Co(CO)_3NO$ monomers and clusters were trapped in He nanodroplets, irradiated with an electron beam of variable energy, followed by detection of fragment ions with a reflectron time-of-flight mass spectrometer.[4] Similar results were observed compared to other electron-induced studies of $Co(CO)_3NO$.[6,7] However, distinct differences between the $Co(CO)_3NO$ gas phase monomer and clustered $Co(CO)_3NO$ are found, providing insight into probable reaction channels for the DEA mechanism of $Co(CO)_3NO$. Further, C_{60} molecules were introduced into He nanodroplets containing $Co(CO)_3NO$ to simulate the influence of a surface on DEA chemistry.

This seminar will introduce the FEBID technique and its application in exploring the electron-induced chemistry of $Co(CO)_3NO$, with emphasis on the research referenced herein. In particular, the DEA mechanism of $Co(CO)_3NO$ within He nanodroplets will be discussed. This is important for understanding fundamental organometallic chemistry, as well as exploring the viability of FEBID for cobalt deposition.

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