# Designing Precursors for the Deposition Technique: CVD vs. EBID

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Precursors for electron beam induced deposition (EBID) are often chosen from compounds developed for chemical vapor deposition (CVD), due to the ready availability of CVD precursors. However, many CVD precursors are unsuitable for EBID because decomposition mechanisms are different under the two sets of conditions. A common result is EBID deposits of low purity due to incorporation of impurities from ligand fragments. Mechanism-based design of precursors for CVD[1, 2] and surface plasmon mediated chemical solution deposition (SPMCSD)[3] will be presented in case studies for contrast with strategies for design of EBID precursors.

The example for CVD will be deposition of tungsten carbonitride ($WN_xC_y$), a potential diffusion barrier material for integrated circuits. Deposition temperature is critical for this application and by studying the decomposition mechanism, we were able to lower the temperature for growth from a single source precursor from 450 to 125 °C.[4] In SPMCSD, the critical features of a precursor are its optical properties and a decomposition temperature matched with the hot spots generated by surface plasmon resonance (SPR). By careful precursor choice, we were able to grow Au nanoparticles from $CH_3AuPPh_3$ upon excitation of the SPR of a Ag film on nanosphere (AgFON) substrate by irradiation with visible light.[3]

In contrast, EBID involves surface reactions under high electron flux, necessitating different precursor design rules.[5] Strategies for adapting selected CVD precursor types for EBID and efforts to identify privileged ligand classes and optimal coordination spheres for precursors will be discussed in the context of new precursors for EBID of Ru, Pt and/or Au.

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