

The role of electron-stimulated desorption in focused electron beam induced deposition - DTU Orbit (09/11/2017)

The role of electron-stimulated desorption in focused electron beam induced deposition

We present the results of our study about the deposition rate of focused electron beam induced processing (FEBIP) as a function of the substrate temperature with the substrate being an electron-transparent amorphous carbon membrane. When $W(CO)_6$ is used as a precursor it is observed that the growth rate is lower at higher substrate temperatures. From Arrhenius plots we calculated the activation energy for desorption, E_{des} , of $W(CO)_6$. We found an average value for E_{des} of 20.3 kJ or 0.21 eV, which is 2.5–3.0 times lower than literature values. This difference between estimates for E_{des} from FEBIP experiments compared to literature values is consistent with earlier findings by other authors. The discrepancy is attributed to electron-stimulated desorption, which is known to occur during electron irradiation. The data suggest that, of the $W(CO)_6$ molecules that are affected by the electron irradiation, the majority desorbs from the surface rather than dissociates to contribute to the deposit. It is important to take this into account during FEBIP experiments, for instance when determining fundamental process parameters such as the activation energy for desorption.

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Authors: van Dorp, W. F. (Ekstern), Hansen, T. W. (Intern), Wagner, J. B. (Intern), De Hosson, J. T. M. (Ekstern)

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