Comparison of gas silver precursors for FEBID: silver-dimethylbutyrate and silver-butylactetelide

Motivation

Focused Electron Beam Induced deposition is direct method of writing structures at a nanometer scale. It is a single step process, which allows to create truly three dimensional structures[1][2][3]. Despite its advantages, there is still a limited number of materials, which were successfully deposited with high level of purity[1].

Silver, due to its plasmonic properties, is one of the most obvious candidates for nano-optical applications[4]. The study compares two potential precursors, from which one was successfully used for creating silver containing nanostructures with electron beam.

Ag - dimethylbutyrate

Solid compound in form of nano-filaments, previously successfully used in CVD [5].

Formula:
\[ \text{C}_6\text{H}_4\text{C}_2\text{H}_5\text{C}(\text{CH}_3)_2\text{O}_2\text{Ag} \]

Behavior under electron beam irradiation at RT (10kV 0.5nA):
Upper: 5s of irradiation,
Lower: after 20s of interaction

Small grains, probably pure silver crystal are visible

EDX measurements taken during irradiation

Results of deposition

FEBID using Ag – tert butyl acetylide with U=15kV, I=0.5-1nA showed only thin carbon structures

Dwell time dependance

From two tested chemical compounds only Ag-dimethylbutyrate was proper precursor for silver FEBID. High sensitivity: halo contains silver grains. Slight dependence between beam dwell time and silver content was observed.

Conclusions

References