

Investigating EUV resists with low-energy electrons

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As a resist is irradiated with EUV-photons, an avalanche of secondary electrons is created that are key to the chemical changes of the resist. Such electrons come in a broad range of energies and, therefore, with a broad range of inelastic mean free paths, which in turn is a characteristic of the resist chosen.

To obtain independent information on such characteristic electron parameters, we refrain from EUV illumination, but rather irradiate the resists directly with electrons, using a low-energy electron microscope (LEEM). We systematically investigate the changes in a resist due to such electrons versus dose and energy (in the range 0-40 eV), as illustrated in Fig. 1. Here, I will discuss our work on PMMA [1,2] and tin-oxo cage resists [3]. In both cases, we find that interpreting the experiments is non-trivial due to the effects of rather complicated charging effects, ranging from negative at low energies to positive at higher energies. [2,3] Upon correcting for that, however, useful data arise which are presented in this talk.

Finally, I will discuss the possibility of determining electron mean free paths directly from experiment, by combining reflection and transmission spectra for low electron energies. Reflection curves are obtained by LEEM, whereas for transmission curves we have developed a new low-energy TEM technique (eV-TEM) which works remarkably well for thin materials like graphene. [4,5]

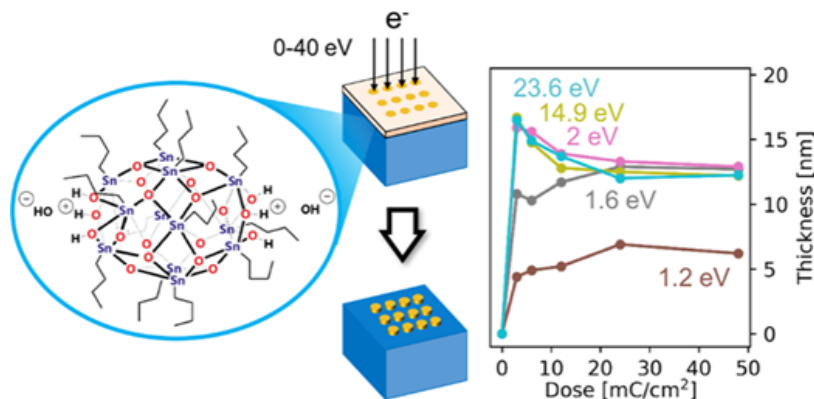


Figure 1. Schematic impression of the experimental method. An electron beam with energies ranging from 0 to 40 eV is used to irradiate a resist layers (tin-oxo cages in this case). The effect of the beam dose and energy is inspected before and after development [3].

References

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