

In situ observation of Au nanoparticles behavior on different substrate during e-beam irradiation

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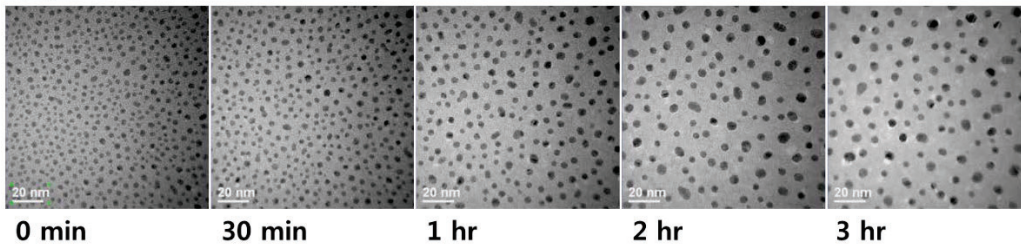
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In-situ observation by transmission electron microscopy (TEM) on behavior of metal nanoparticles with sub 10nm has been performed for the study on nucleation and growth in initial stage of thin film growth or on nanoparticle aggregation as a temperature. It has been revealed that Au nanoparticles with several nanometer scale move, rotate, change the crystal structure and aggregate each other without heating of the samples under the e-beam irradiation in TEM. The behavior of Au nanoparticles under the e-beam irradiation has been explained by temperature increment by e-beam irradiation or charging by inelastic scattering of electron such as secondary electron generation, ionization etc.

We observed the behavior of Au nanoparticles on pure carbon and SiO membrane under the e-beam irradiation. Au nanoparticles sputtered and the target thickness was about 0.5 nm. Average diameter and areal density of Au nanoparticles was about 3 nm and 4 #/(10nm*10nm), respectively. In situ observation of Au nanoparticles in TEM with 200kV was performed for 5 hr and recorded to video file. Electron flux was 1.5×10^5 e/nm²sec.

The behavior of Au nanoparticles on pure carbon and SiO as e-beam irradiation time was extremely different. Au nanoparticles on SiO membrane travel and aggregate after 15min of e-beam irradiation. The nanoparticle size increased with the increase of the irradiation time. After 2hr, Au nanoparticles grow up to about 5 nm and the density of Au nanoparticle decrease to 1 #/(10nm*10 nm). However, during e-beam irradiation for 4 hr, Au nanoparticles on pure carbon did not actively move and then, particle size and density did not change. In this presentation, we will show the movie of the Au nanoparticle under the e-beam irradiation and discuss about different behavior of Au nanoparticles on different substrate for a long time e-beam irradiation.

(a) Au particles on SiO membrane



(b) Au particles on C membrane (20~30nm)

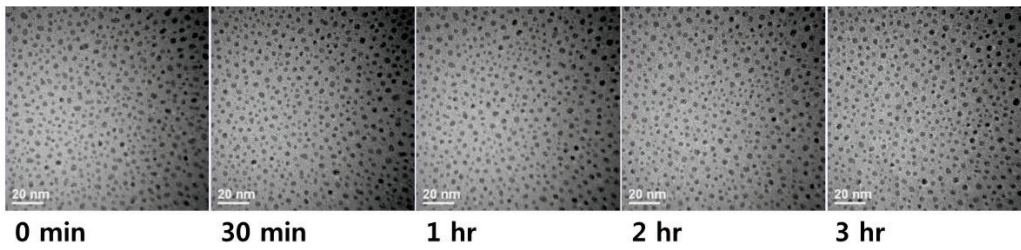


Figure 1: Au nanoparticles evolution on different substrate by electron beam exposure; (a) Au particles on SiO membrane and (b) Au particles on C membrane