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Coalescence between Au nanoparticles as-induced by nanocurvature effect and electron beam athermal activation effect

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The coalescence of two single-crystalline Au nanoparticles on surface of amorphous SiOx nanowire as induced by electron beam irradiation was in-situ studied at room temperature in transmission electron microscope. It was observed that along with shrinkage of the SiOx nanowire during the irradiation, adjacent Au nanoparticles moved around and migrated close to each other. Once the two nanoparticles contacted with each other, fast, massive atom transportation took place nearby their contacting surface region where a neck region was created. With a further irradiation, the two nanoparticles rotated and aligned their crystal orientations and gradually coalesced into a bigger single crystalline nanoparticle. The above coalescence process demonstrated an intriguing surface nano-wetting ability and nano-grain boundary dislocation climbing and slip of Au NPs at room temperature as driven by the non-uniformly distributed nanocurvature over the surface of the two contacted nanoparticles as well as the beam-induced instability and soft mode of atom vibration, which were underestimated or neglected in the existing theoretical descriptions or simulations.

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