

## **Description of Additional Supplementary Files**

### **File Name: Supplementary Movie 1**

**Description:** A movie of in-situ TEM images showed the transformation of Pd NPs to Pd SAs occurring in the temperature window from 100°C to 900°C under Ar atmosphere. The movie revealed that the migration and aggregation of Pd NPs were largely prohibited by the carbon layers, and thermal atomization would be initiated and accelerated with the temperature rise, resulting in a gradually decreasing particle number of supported Pd NPs.