

# **In-flight gas-phase growth of graphene-metal nanoparticles with controllable sizes**

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## **S1 Sintering effect on Pd-C nanoparticles**

Morphological changes in the Pd-C nanoparticles on increasing the sintering temperature are shown in Fig.1. Initially nanoparticles are just the agglomerates consisting of small sized primary nanoparticles. As we increase the sintering temperature to 300 °C, primary particles start merging into each other and compaction process starts. Thereafter, at a sintering temperature of 500 °C, compact, quasi-spherical nanoparticles are formed. Finally, sintering at 700 °C results in formation of nearly spherical graphene-Pd nanoparticles.

## **S2 Size selected graphene-Cu and graphene-Pd nanoparticles**

TEM images of size selected graphene-Cu and graphene-Pd nanoparticles are shown in Fig.2. Agglomerates of  $D_m = 35, 52, 68$  nm were sintered to form the graphene-Cu and graphene-Pd nanoparticles. It is clear from the histograms shown in Fig.3, that particles have a very well defined size and a narrow size distribution. HRTEM images of the well formed graphene-Pd nanoparticles having  $D_m = 68$  and  $52$  nm are shown in Fig.4. A shell having 3-4 layers of graphene is clearly observable around the Pd nanoparticle core. For comparison HRTEM image of a Pd nanoparticle grown using Pd electrodes only is also shown in which no graphene shell is observable.

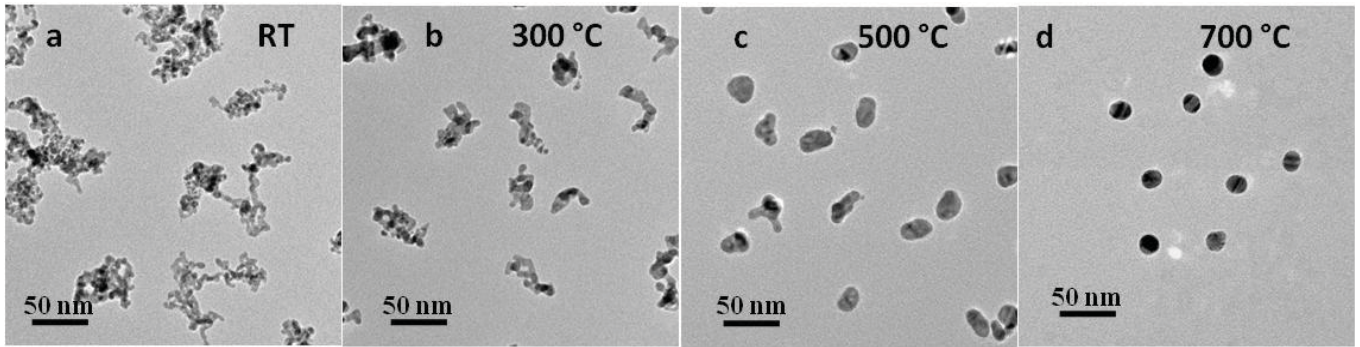


Fig.1 TEM images showing the changes in the in Pd-C nanoparticles sintered at different temperatures

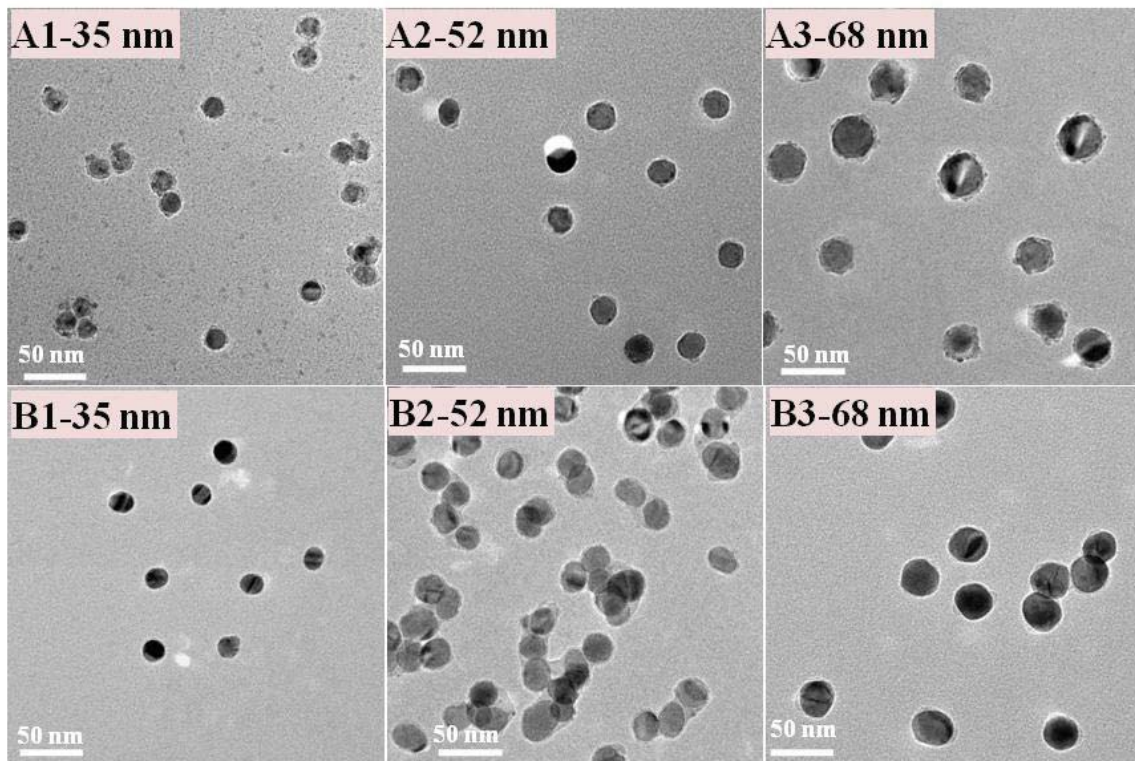


Fig.2 TEM images showing size selected graphene-Cu (A) and graphene-Pd (B) nanoparticles of  $D_m = 35, 52, 68$  nm

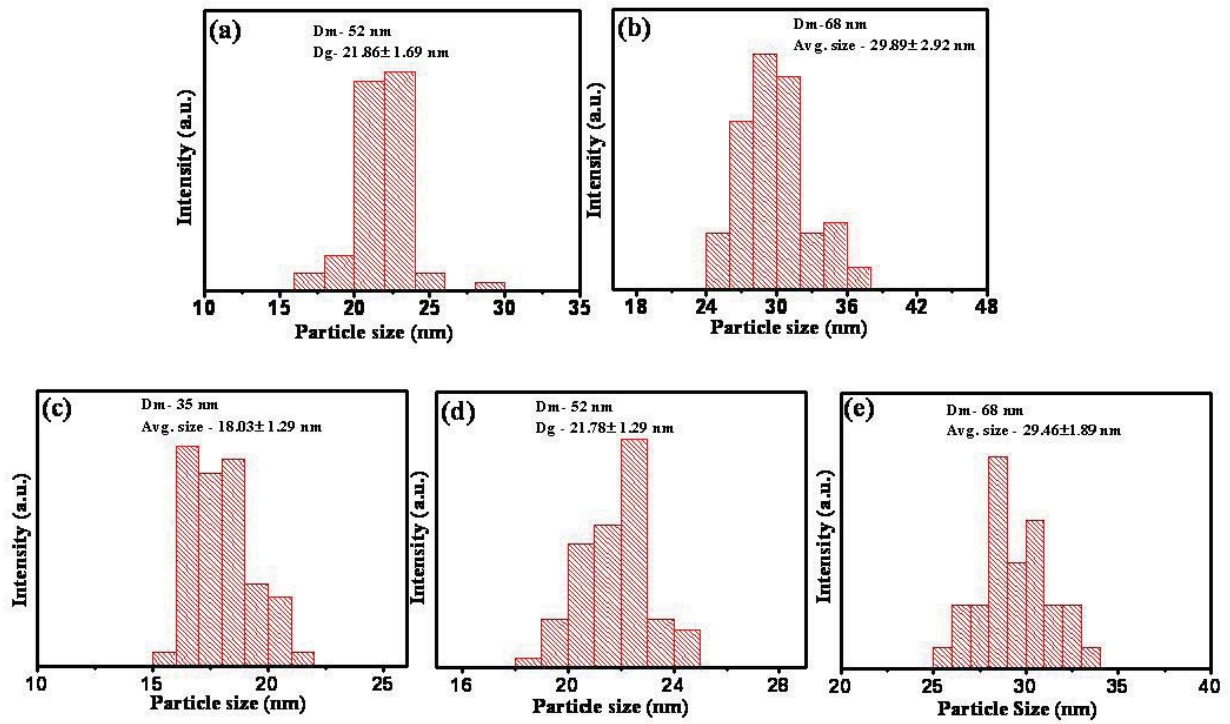


Fig.3 Histograms showing the size distribution of Cu-C [(a),(b)] and Pd-C [(c), (d), (e)] nanoparticles.

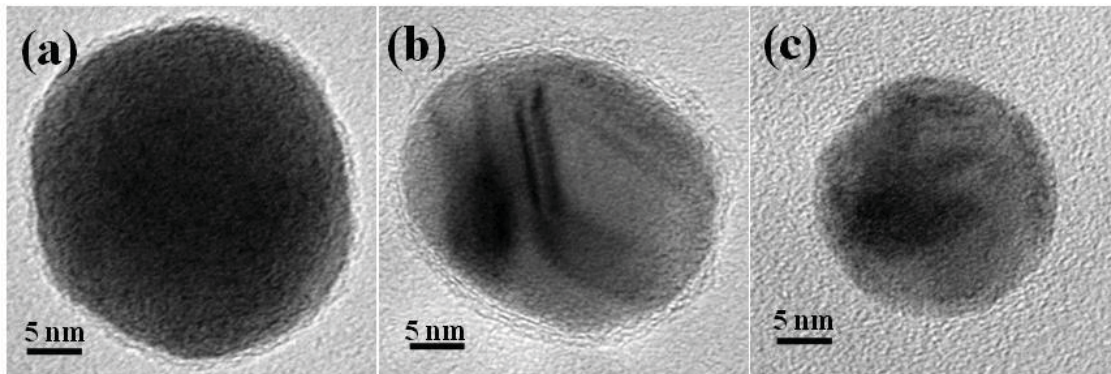


Fig.4 HRTEM micrographs showing graphene-Pd nanoparticles of Dm= (a) 68 nm and (b) 52 nm. (c) For comparison HRTEM image of a Pd nanoparticle is also shown in which no carbon shell is observable