Supporting Information

Pressure-induced Assemblies and Structures of Graphitic-Carbon Sheet Encapsulated Au Nanoparticles

Partha Pratim Das[1], Sudeshna Samanta[2,3], Douglas A. Blom[4], Srikrishna Pramanik[5], P. Sujatha Devi[6], Thomas Vogt[7], Yongjae Lee[1,2,*]

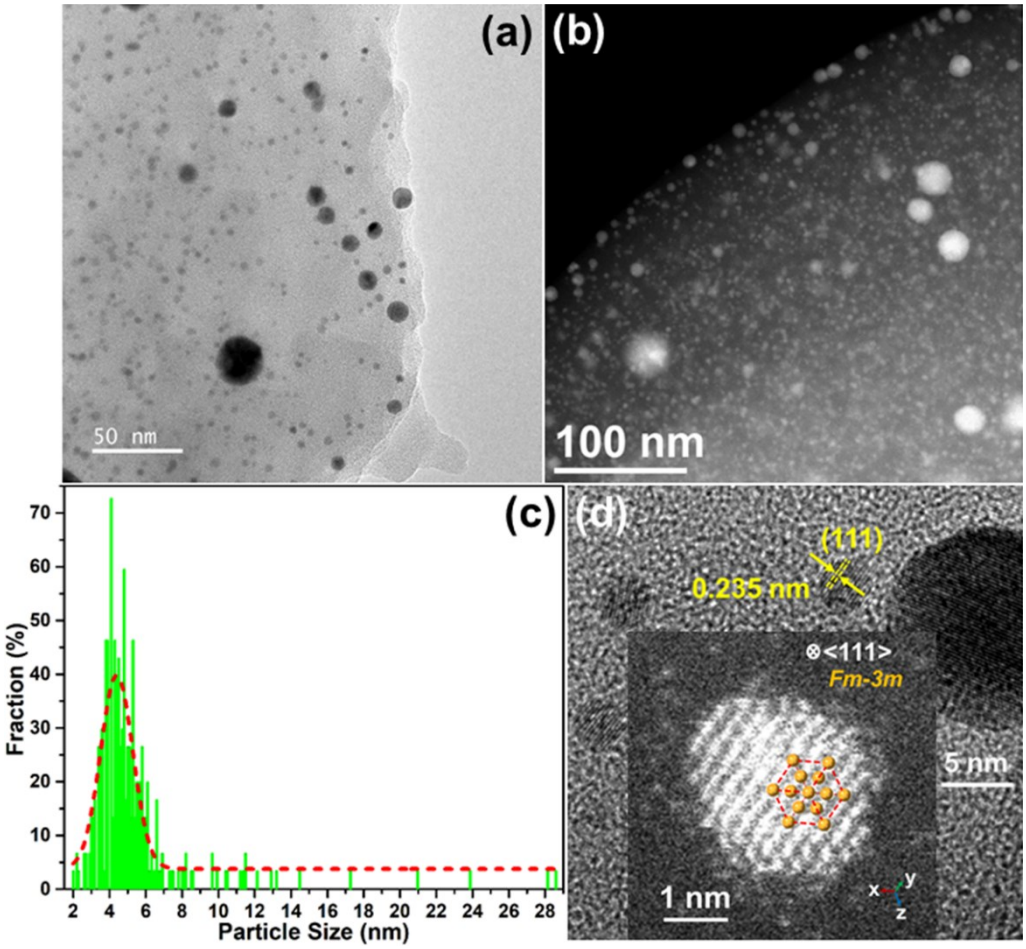

Fig. S1. (a) Bright-field TEM image and (b) HAADF image of Au nanoparticles embedded in carbon sheets, (c) size distribution histogram of the Au nanoparticles (inset), (d) HRTEM image of the Au nanoparticles, HAADF image of the Au nanoparticle and the atomic structure model of *fcc* (*Fm-3m*) Au (inset).

Calculation of strain: We have estimated the pressure-induced evolution of the microscopic strain for the Au nanoparticles encapsulated by carbon sheet by the Williamson-Hall (W-H) plot. It describes as follows '$(\beta_{obs} - \beta_{inst})\ Cos\theta = \lambda/D_v + 4\epsilon_{str}\ Sin\theta$', where β_{obs}, β_{inst}, D_v and ϵ_{str} respectively represents the observed and instrumental integral breadth regarding the Bragg angle 2θ of the *fcc* (*Fm-3m*) Au phase, the volume weighted crystallite size and the weighted strain. The distribution of strain with pressure is displayed as Figure S2(c).

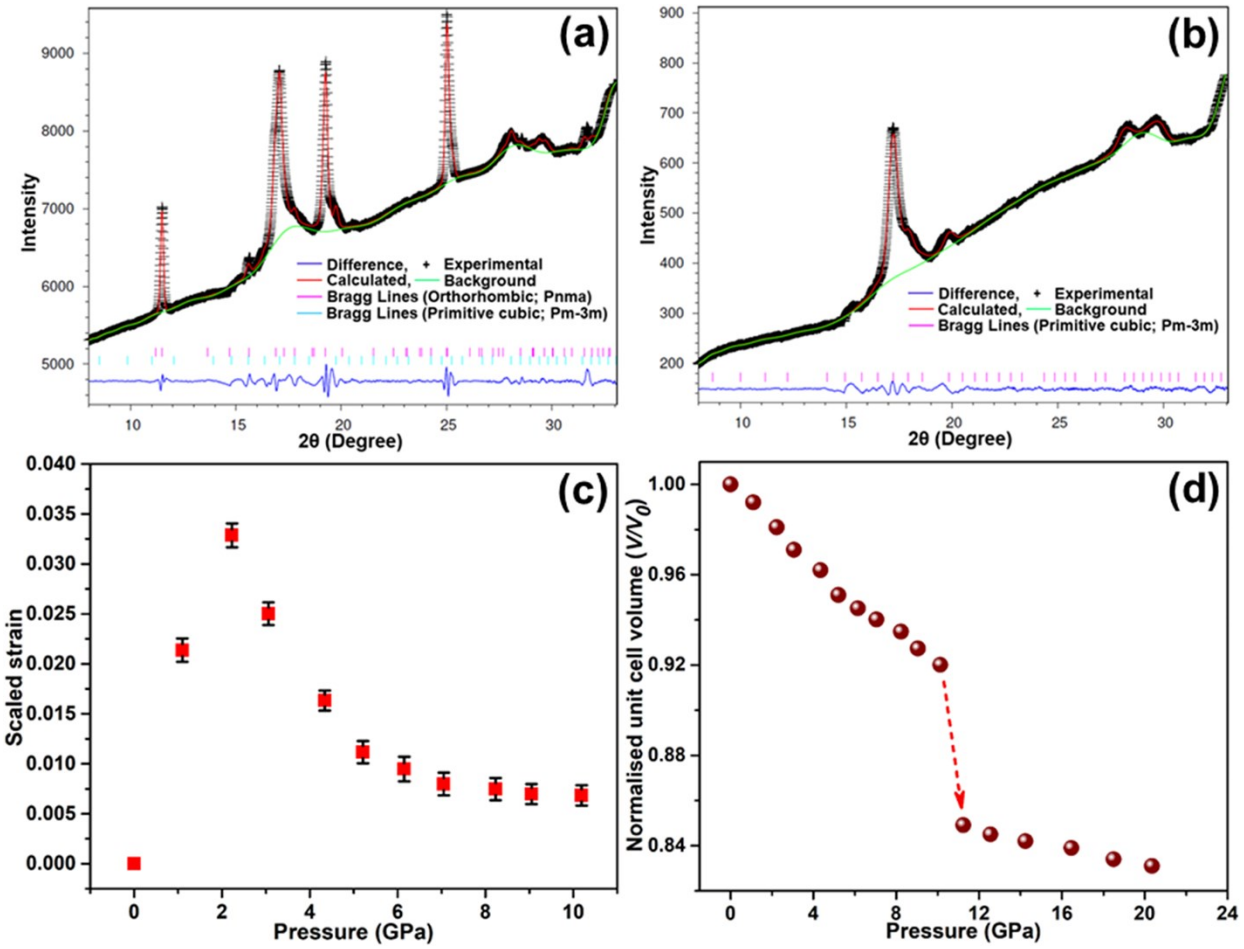

Fig. S2. Whole profile fitting of X-ray diffraction patterns of the Au-carbon hybrid during compression at (a) ~14.2(1) and (b) ~22.1(1) GPa, (c) The scaled strain for the carbon sheet encapsulated Au nanoparticles analyzed from a Williamson-Hall plot, (d) variation in V/V_0 of the

carbon of the hybrid with pressure.

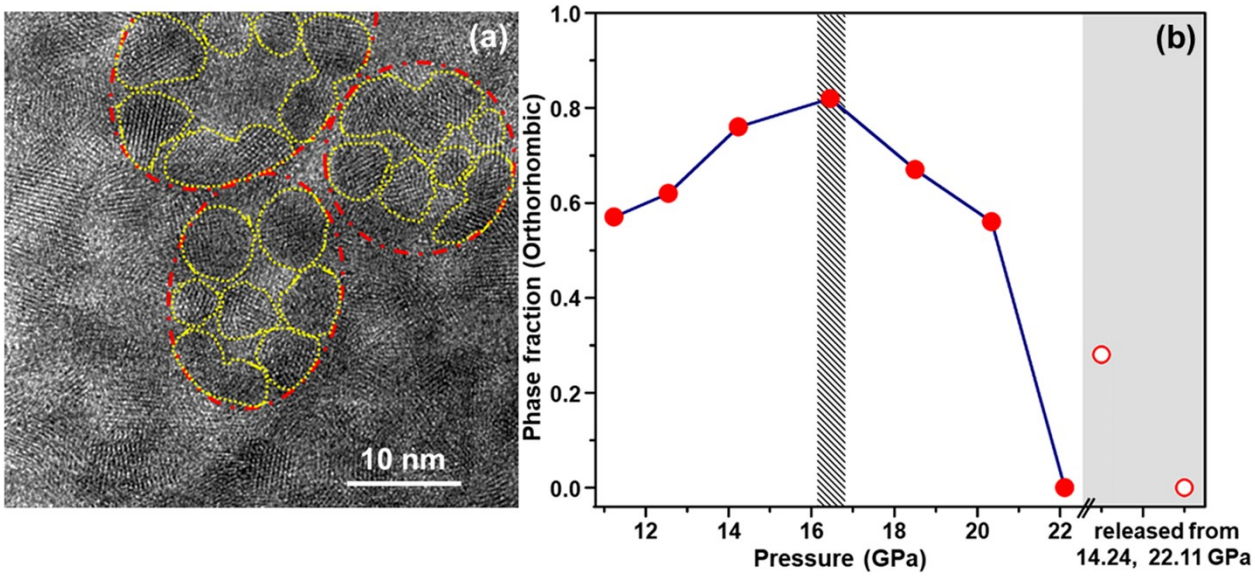

Fig. S3 (a) TEM image of the Au-carbon hybrid released from ~14.2(1) GPa, (b) phase fraction of the orthorhombic structure of Au with pressure.