Supplementary Information

Properties of room-temperature ferromagnetic semiconductor in manganese doped bilayer graphene by chemical vapor deposition

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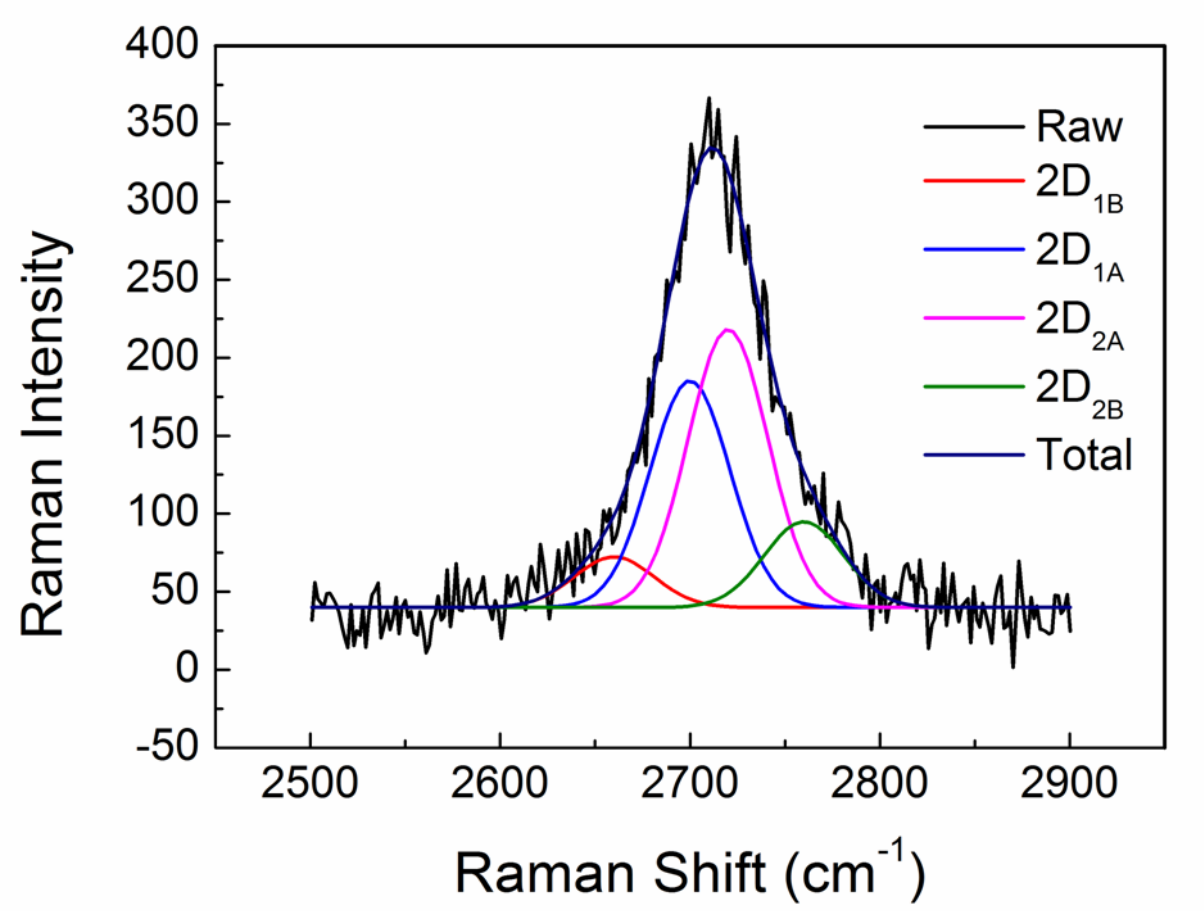
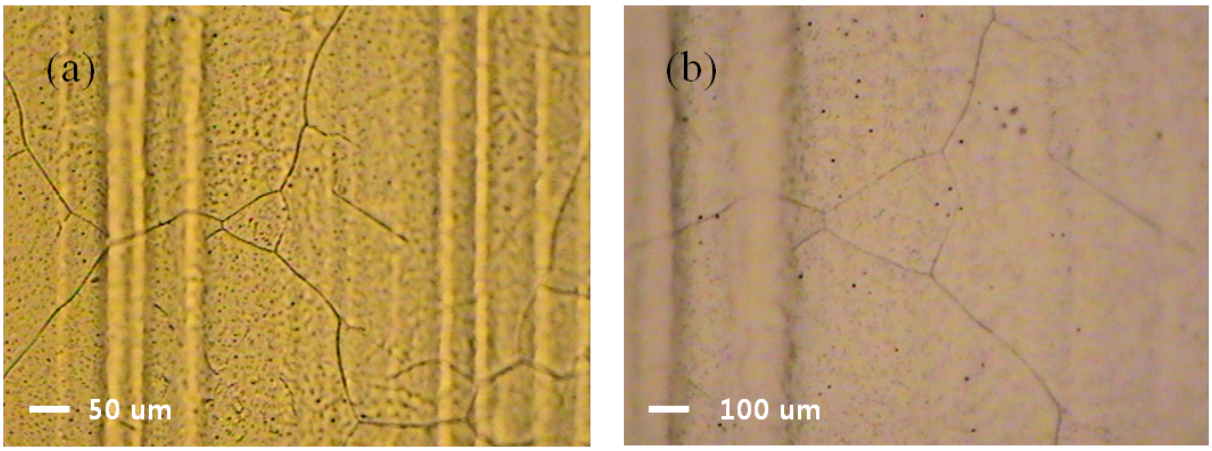
To investigate the doping quality of manganese in graphene, firstly, we measured optical microscope for seeing the morphology of the Mn doped graphene film. Figure S2 shows clear images of graphene surface. Dark dot distributions on the graphene surface indicate that the manganese atoms to bind with carbon during the growth are diffused out of graphene layers. In order to directly confirm the manganese composition of graphene, we measured the electronic structure of the Mn doped graphene by using XPS. Figure S3 shows the wide scan of the Mn doped graphene film on Cu. The atomic percentage of Mn is 34.4%. This high ratio can be interpreted by Mn dot distributions on graphene, which was identified in figure S2.

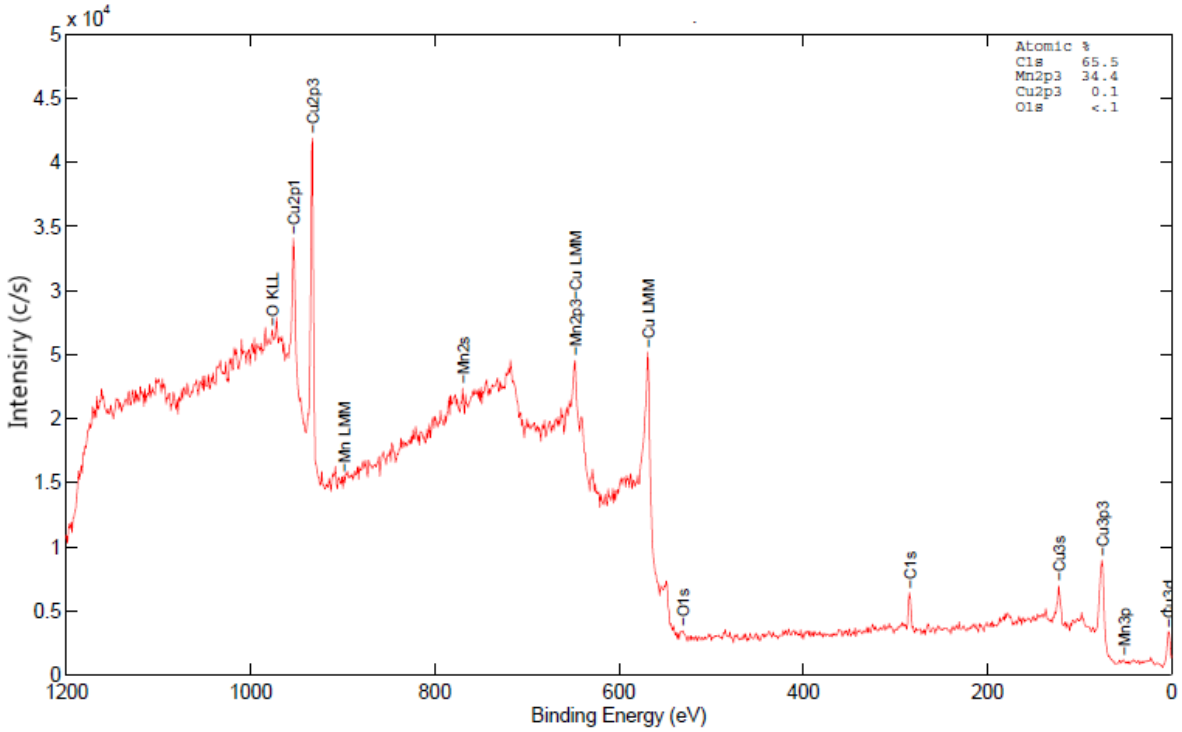
Secondly, we identified the spectra of C 1s and Mn 2p peaks in Figure S4. Figure S5 shows (a) the image and (b) the electron diffraction patterns of TEM taken from samples of the Mn doped graphene with Mn concentration of (b) 34.4%. The TEM plan view image shows relatively good surface including Mn although small dark dots of manganese clusters partly take place due to high Mn concentration in figure (a). The diffraction patterns contain a ring pattern due to the presence of oxidized manganese on the surface.(New Journal of Physics 10, 115002, 2008) The Mn doped graphene reveal spots related to graphene and Mn. It clearly exhibits a six-fold symmetry, as expected from graphene.



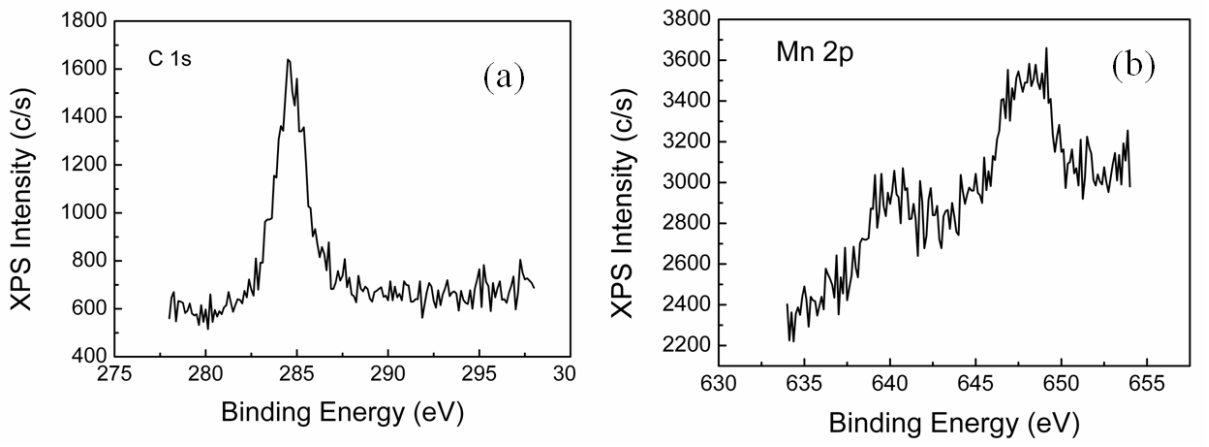
S 1| The enlarged 2D peaks of the Mn doped graphene shown in figure 1 ranging from 2500 to 2900 cm^{-1}. The four satellite peaks, which are the $2D_{1B,}$ $2D_{1A}$, $2D_{2A}$, and $2D_{2B}$ peaks, from the left, are shown as the Lorentzian fitting of the 2D peaks.



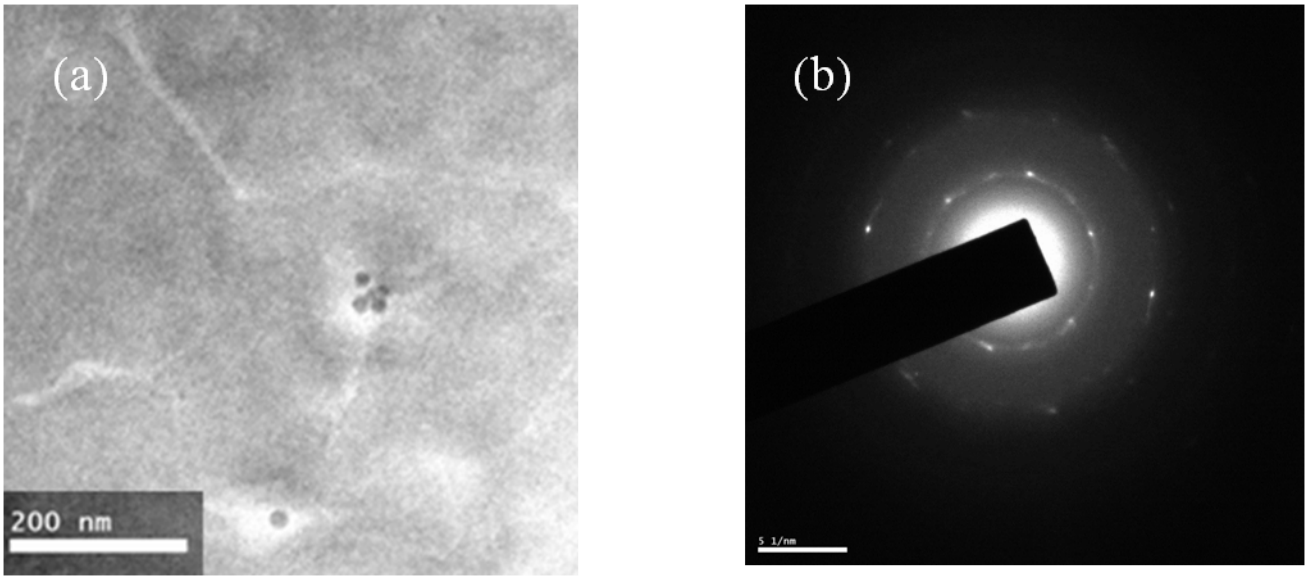
S 2| (left) Optical microscope image of the Mn doped graphene on Cu substrate (x 50). (right) Optical microscope image of the Mn doped graphene on Cu substrate (x 100).



S 3| XPS wide scan profile of the Mn doped graphene film on Cu. The atomic percentage of Mn is 34.4%. This high ratio can be interpreted by Mn dot distributions on graphene, which was identified in Figure S1.



S 4| XPS spectra of C1s (a) and Mn 2p peaks (b) of the Mn doped graphene.



S 5| The TEM image (a) and the electron diffraction patterns (b) of the Mn doped graphene.