Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Electronic Supplementary Information

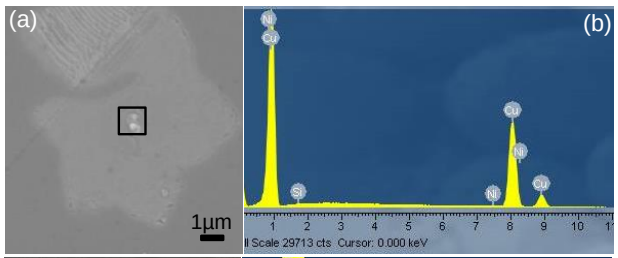
Correlation between nanoparticle location and graphene nucleation in chemical vapour deposition of graphene

Lili Fan[1], Kunlin Wang[1], Jinquan Wei[1], Minlin Zhong[1], Dehai Wu[2], Hongwei Zhu[1,3*]

[1]School of Materials Science and Engineering, State Key Laboratory of New Ceramics and Fine Processing, Key Laboratory of Materials Processing Technology of MOE, Tsinghua University, Beijing 100084, P. R. China

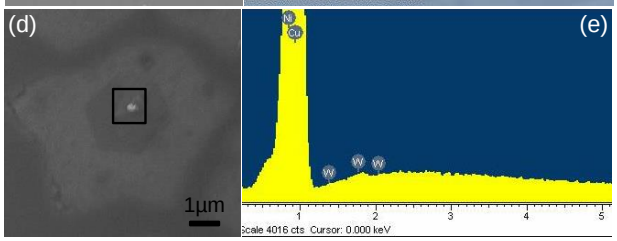
[2]Department of Mechanical Engineering, Tsinghua University, Beijing 100084, P. R. China

[3]Center for Nano and Micro Mechanics, Tsinghua University, Beijing 100084, P. R. China



(c)

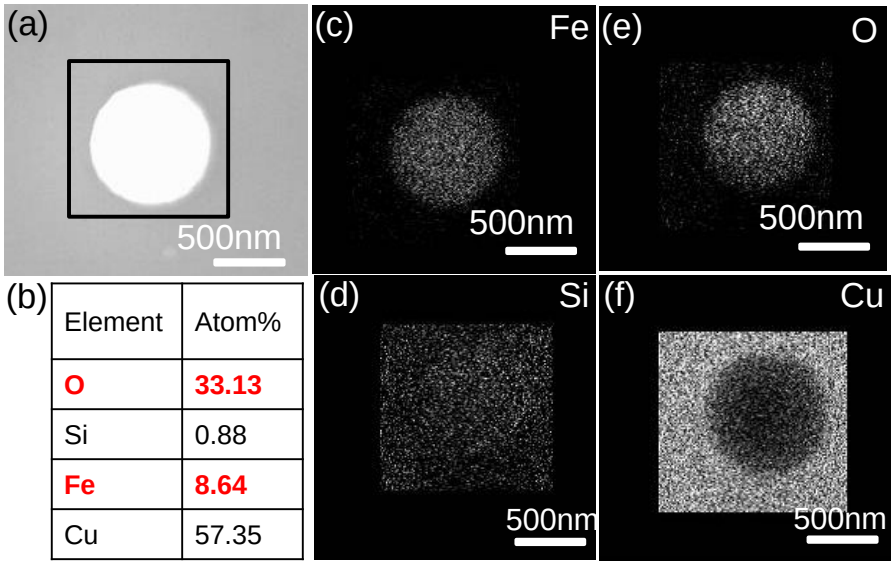
Element	Weight%	Atom%
Si	0.27	0.59
Cu	102.01	99.41



(f)

Element	Weight%	Atom%
W	0.50	0.21
Cu	81.32	99.79

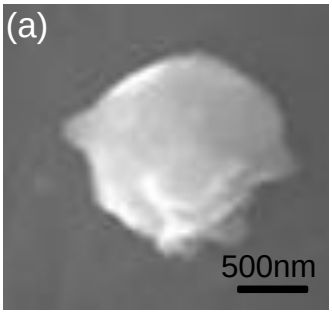
Figure S1. Elemental analysis composition of nanoparticles located on the center of graphene domains. (a,d) SEM images of nanoparticles on the center of graphene domains. (b,e) Corresponding EDS results and (c,f) elemental compositions.



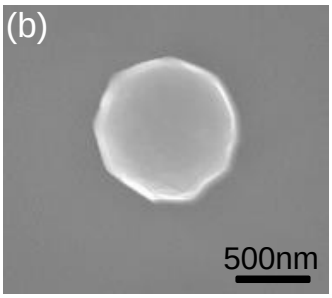
(b)

Element	Atom%
O	**33.13**
Si	0.88
Fe	**8.64**
Cu	57.35

Figure S2. (a) SEM image of a large particle. (b) Elemental composition. (c~f) Elemental mappings. The images show the shapes of corresponding components. Only c and e are consistent with that in a. Hence, the nanoparticles are consisted of Fe and O.



Element	Weight%	Atom%
C	4.85	82.96
Al	**0.05**	**0.41**
Si	**0.13**	**0.98**
Ca	**0.09**	**0.48**
Cu	4.69	15.17



Element	Weight%	Atom%
C	**6.49**	**68.56**
Cu	15.74	31.44

Figure S3. Elemental composition of two typical large particles. (a) Irregular shape (Al, Si, and Ca). (b) Round shape (C).

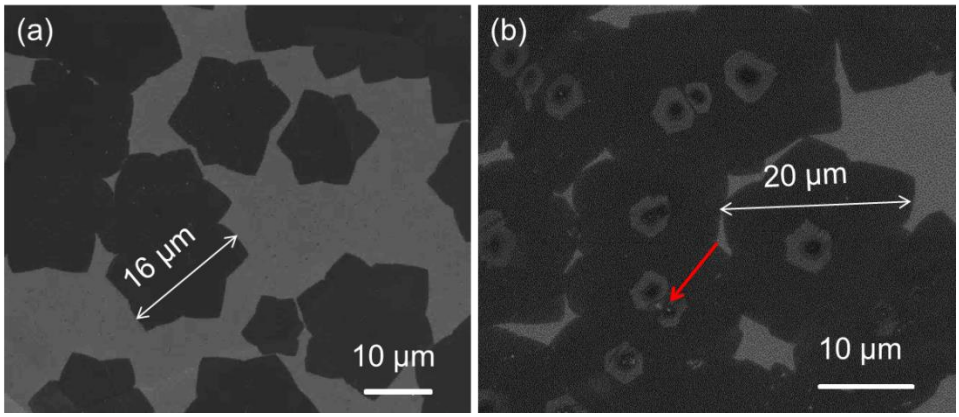


Figure S4. (a) SEM image of graphene domains with uniform thickness. (b) SEM image of multilayer graphene domains.

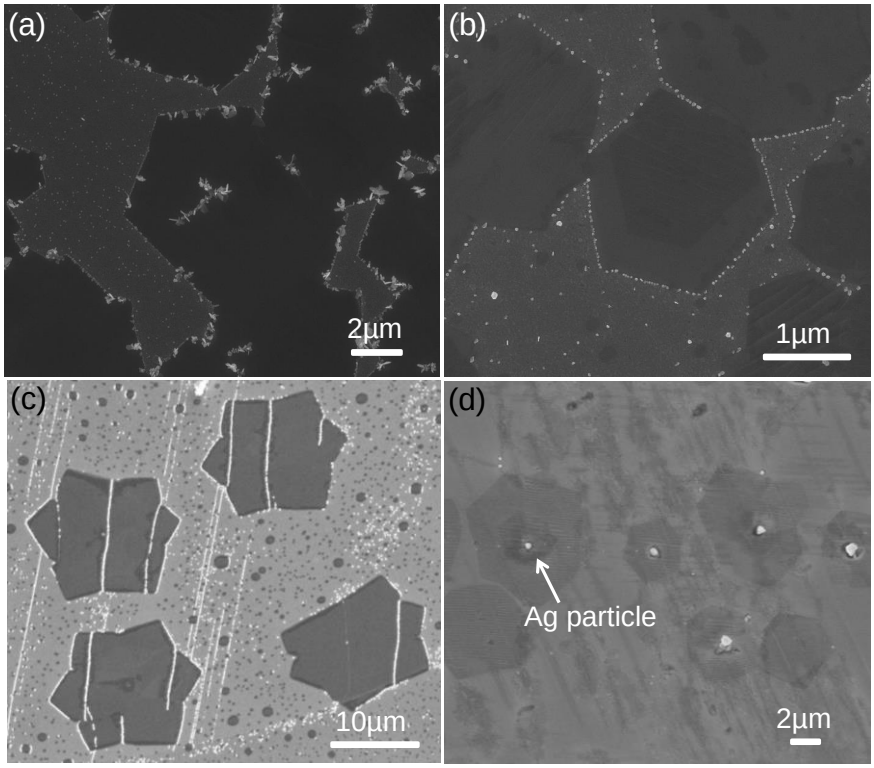


Figure S5. Deposition of Ag particles on graphene domains. (a,b) Ag particles gathering on the edges of graphene domains. (c) Deposition of Ag particles on cracked graphene domains; (d) Ag particles deposited at the centers of multilayer graphene domains.

Graphene domains on copper substrates were immersed in $AgNO_3$ solution (0.01~0.1 mM) for 15 min for the deposition of Ag particles. Generally, Ag particles tend to deposit on the edges

and defects of graphene domains (Figs. S5a-c) [S1]. In Fig. S5d, Ag particles locate in the centre of multilayer graphene domains similar to the nanoparticles in this work, demonstrating that the centre parts are active sites for multiple particles. Besides, the deposition of Ag particles depends on post-treatment process, which also demonstrates that the nanoparticles can form later than graphene, and share the same nucleation sites with it.

Reference:

[S1] Li, Z., et al., Graphene buffered galvanic synthesis of graphene-metal hybrids. JOURNAL OF MATERIALS CHEMISTRY, 2011. 21(35): p. 13241-13246.