Electronic Supplementary Material (ESI) for RSC Advances.

Growth kinetics of gold nanoparticles on silica/graphene surfaces for multiplex biological immunoassays

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Supplemental materials

Preparation of MB-rGO

After: X. Cai, S. Tan, A. Xie, M. Lin, Y. Liu, X. Zhang, Z. Lin, T. Wu and W. Mai, Mater. Res. Bull., 2011, 46, 2353-2358.

60 mg of methyl blue, MB, was added to 40 ml GO dispersion (0.5 mg/mL) and the mixture was sonicated for 40 min to obtain MB-GO dispersion. Then 8 mL of 50 wt% hydrazine monohydrate solution in water was added to MB-GO dispersion and the solution was incubated at 85 °C for ca. 24 hours. The MB-rGO product was purified by 5 times repeated centrifugation-redispersion in deionized water cycles.

Preparation of BSA-rGO and FG-rGO

After: J. Liu, S. Fu, B. Yuan, Y. Li and Z. Deng, *J. Am. Chem. Soc.*, 2010, **132**, 7279-7281.

250 µL of 2.0 mg/mL GO was added to 4.75 mL of 20 mg/mL protein solution, either bovine serum albumin (BSA) or fibrinogen (FG). The pH of the mixture was adjusted to 12 with 1M NaOH. The mixture was incubated at 90 °C for ca. 5 hours. During this time the reaction mixture colour changed from light yellow-brown to deep black, indicating the successful reduction of the GO. The BSA/FG-rGO products were purified by 5 times repeated centrifugation-redispersion in deionized water cycles.

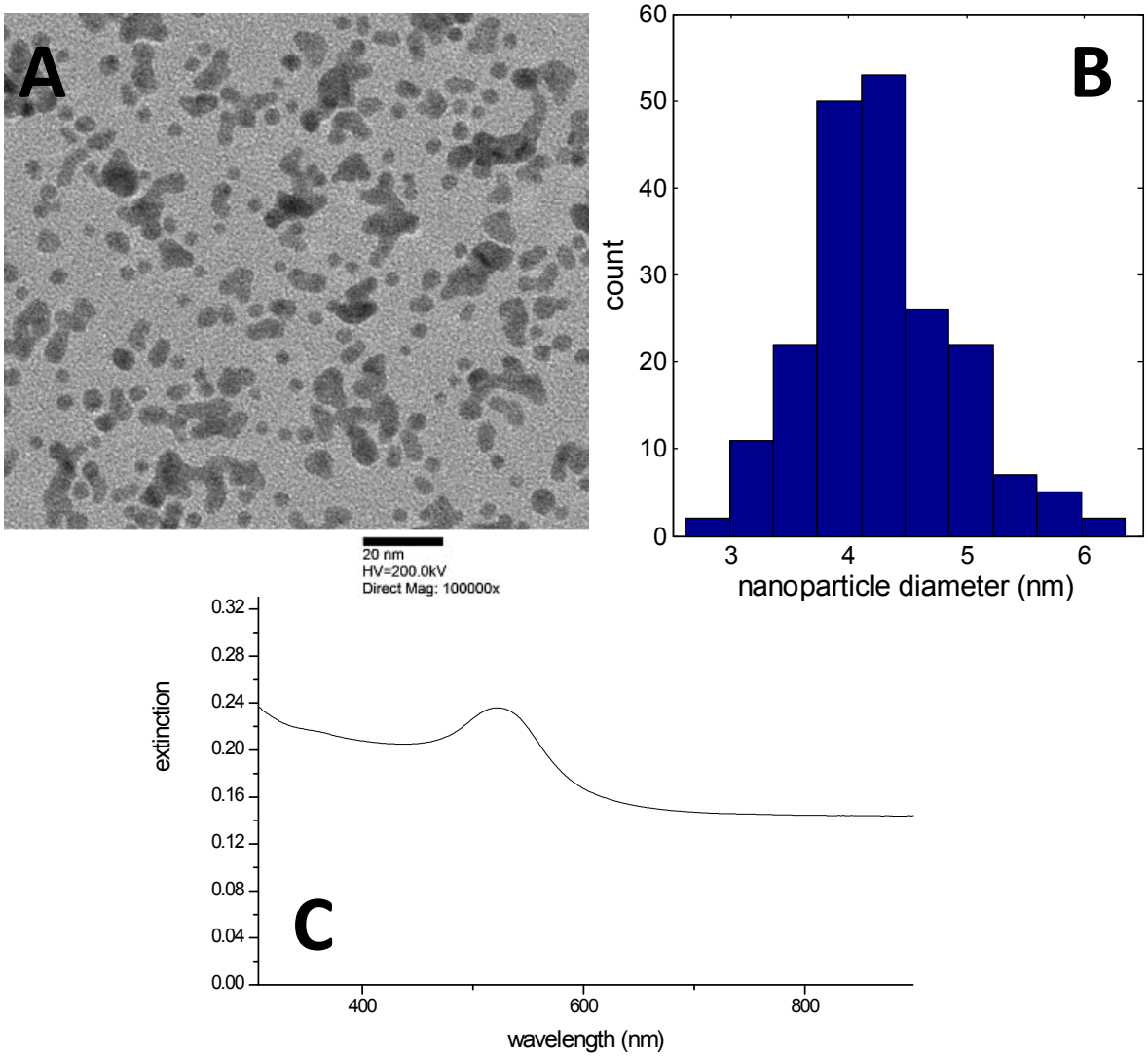

Fig. S1. Gold seed particles prepared by rapid sodium borohydride reduction of auric chloride in the presence of a citrate surface ligand: (A) TEM image of the seed colloid sample; (B) size distribution histogram, mean±σ is 4.3±0.6 nm (aggregated particles were not used in counting); (C) UV-VIS spectrum of the gold seed particles colloid.

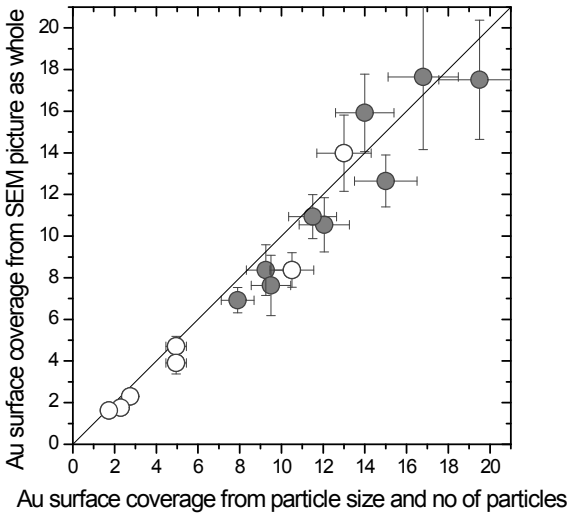

Fig. S2. Particle densities and sizes observed in SEM image data: correlation of total gold surface areas derived directly from SEM image and calculated from estimated particle surface densities and their sizes.

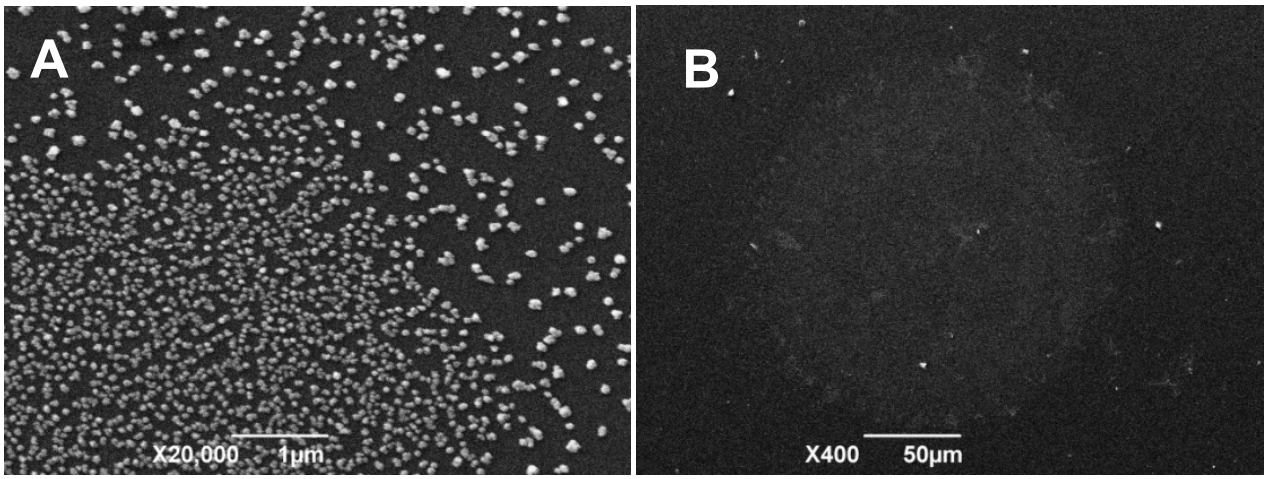

Fig. S3. SAM images of gold nanoparticles on MB-rGO substrate: (A) the areas with high particle densities are interpreted as the bare aminated glass substrate gaps between graphene coating, the latter carries negative charge and thus repels negatively charged gold particles which tent to gather between MB-rGO flakes on positively charged aminated glass surface; (B) low resolution SEM image of the sensor spot shows that these high nanoparticle density areas constitute only small fraction of the whole spot area.

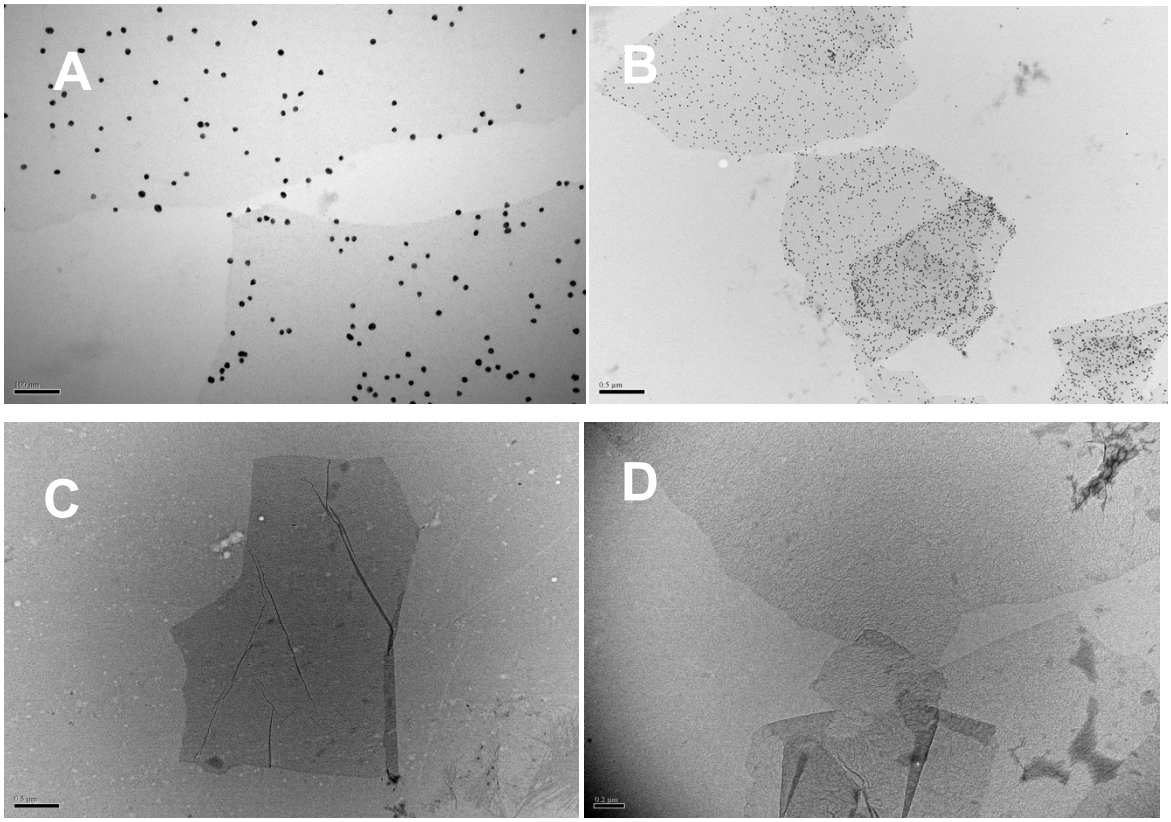

Fig. S4. TEM images of graphene material aqueous dispersions incubated with gold colloid. The BSA-rGO (A) and FG-rGO (B) samples are decorated with gold nanoparticles, while the MB-rGO (C) and GO (D) do not show any captured particles.

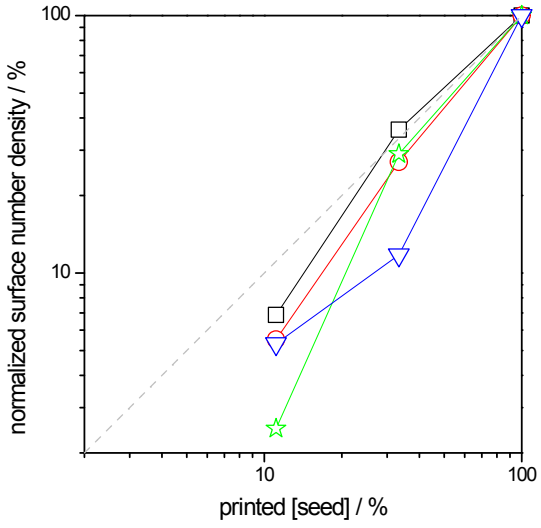

Fig. S5. Particle densities and sizes observed in SEM image data: correlation between the observed surface particle number densities and printed concentrations of the seed colloid: ASG (square), GO (circle), BSA-rGO (star), MB-rGO (triangle).

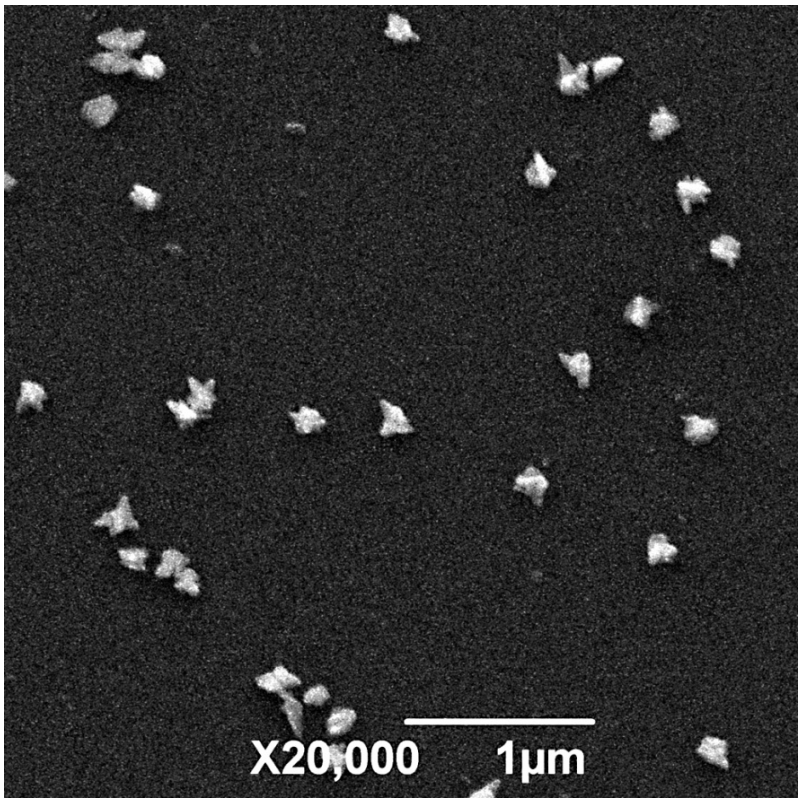

Fig. S6. Sharper geometrical features forming at the later stage (>100nm in diameter) of the particles grown on reduced graphene oxide surface.