Electronic Supplementary Information

Sintered Gold Nanoparticles as an Electrode Material for Paper-Based Electrochemical Sensors

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Raman Spectroscopy

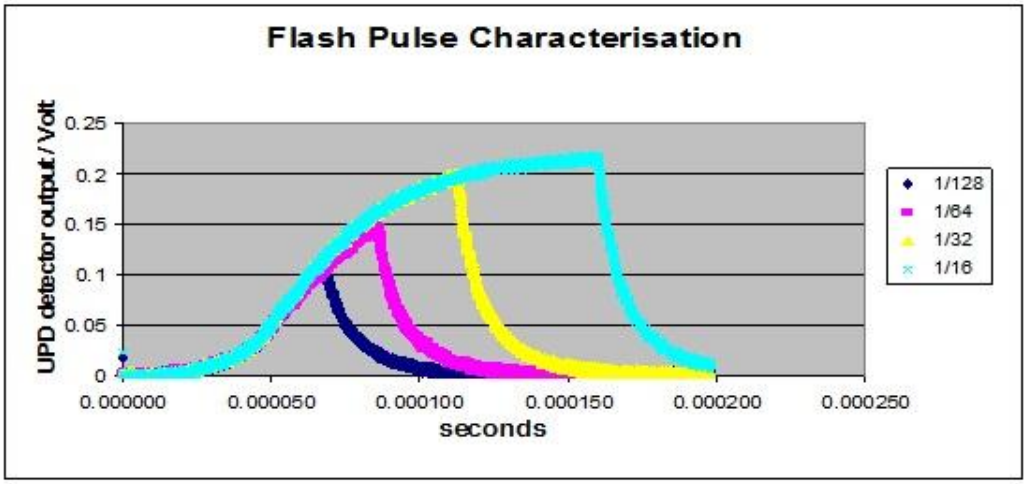
Table S1. Vibrational assignments obtained from Raman spectroscopy of a DMAP crystal and DMAP-gold nanoparticle film.

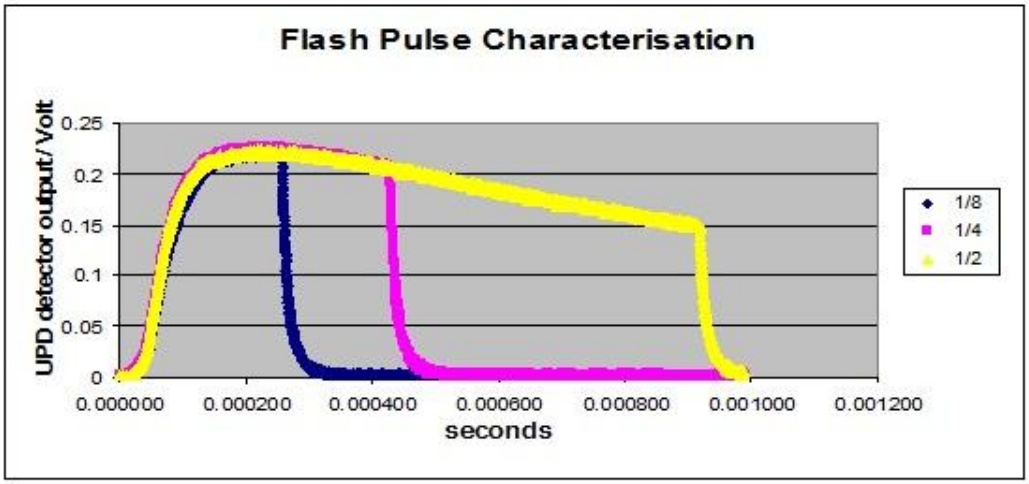
Wavenumber of DMAP crystal (cm^{-1})	Wavenumber of DMAP-gold nanoparticle (cm^{-1})	Vibrational assignment
121	119	CH_3 torsion
751	761	C-N-C wagging
950	948	Ring breathing, CH_3 rocking and C-H out-of-plane bending
987	1012	Trigonal bending and C-H out-of-plane bending
1065	1065	CH_3 rocking
1232	1228	C-H in-plane bending
1591	1613	C-C aromatic stretching
2750-3100	2750-3000	C-H stretching

Energy from Camera Flash Unit

Determination of energy per flash is made by calculation. As can be seen from the flash pulse characterisation curves (Fig. S1), for flash output settings 1/16 to 1/1 the peak power is attained in approximately 150 - 200 μs, but decays somewhat as the flash discharge continues, until the discharge is quenched by the circuitry. The exception is the 1/1, or full output, in which the capacitor is allowed to discharge completely. Therefore the energy is related neither to power, nor duration.

Having captured the flash pulse curves, and measured the peak powers in volts (using the fast detector), a value for the area under each curve is calculated in units of volt.seconds. These are converted to Watt.seconds by applying the ultrafast photodiode work function. The area is now in Joules. Note that since the conversion gives the energy in Watts per unit area of the detector, the energy figure is in Joules per square centimetre. The energy as a function of distance at different flash output settings is illustrated in Fig. S2.





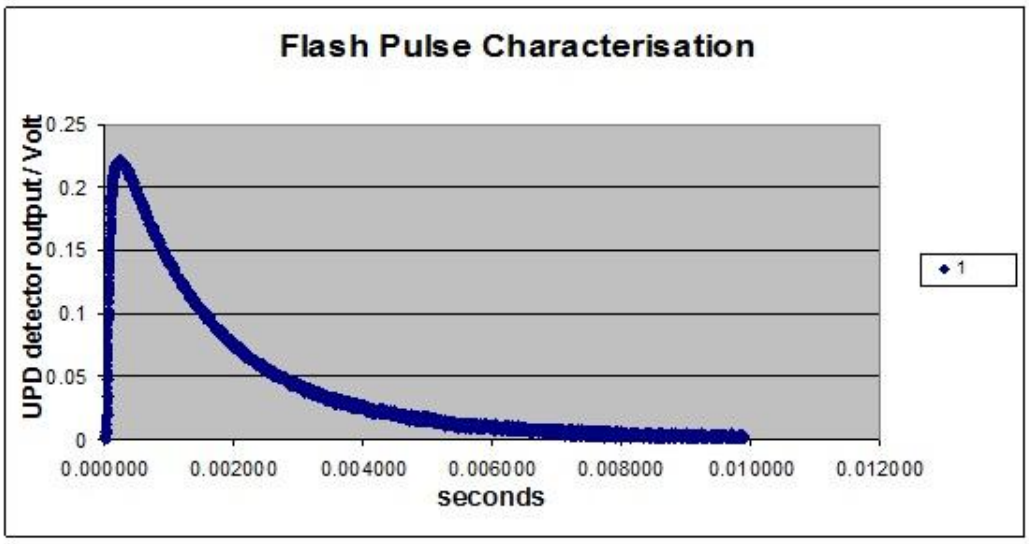


Fig. S1. Flash pulse characterisation curves at **(a)** 1/128, 1/64, 1/32 and 1/16 flash output **(b)** 1/8, 1/4 and 1/2 flash output and **(c)** 1/1 flash output.

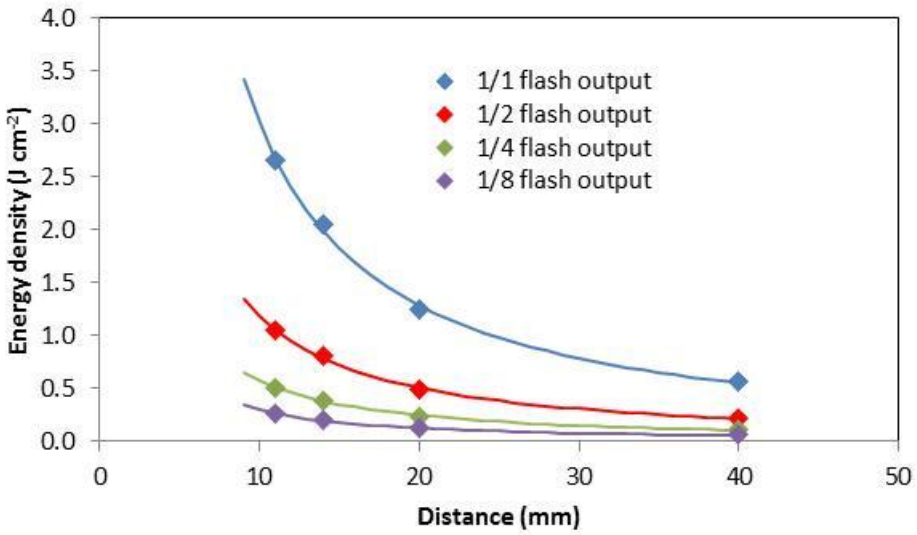


Fig. S2 Energy density per flash as a function of flashing distance for various flash output settings.

Square Wave Voltammetry

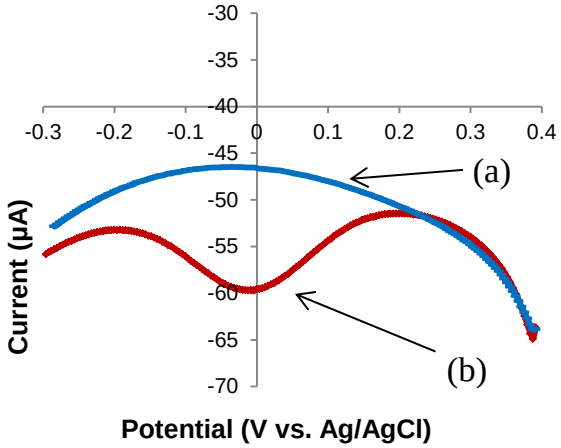


Fig. S3 Square wave voltammograms for the reduction process at a cysteine-modified sintered gold nanoparticle film paper electrode (1.1 cm flashing distance) measured in 50 mM ammonium acetate (pH 7.0) and 50 mM NaCl before accumulation of copper ions (blue curve) and after accumulation in 280 ppb copper for 10 minutes (red curve). Square wave voltammetry was performed at a pulse amplitude of 0.025 V, a step of 0.004 V and frequency of 50 Hz.