Supportive information

A Rugged, Self-sterilizing Antimicrobial Copper Coating on Ultra-High Molecular Weight Polyethylene: a Preliminary Study on the Feasibility of an Antimicrobial Prosthetic Joint Material

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AACVD of *In-Situ* Precursors

The depositions were undertaken in a cold-wall horizontal-bed CVD reactor (internal dimensions: 15 cm × 5 cm), illustrated in Figure 1. The reactor contained a bottom plate (substrate) along with a brass top plate. Depositions were carried out on the barrier, to prevent possible ion exchange. A graphite block (containing a Whatman cartridge heater monitored by a platinum-rhodium thermocouple) heated the bottom plate. The top stainless-steel plate was positioned 0.7 cm above the bottom plate and the assembly was enclosed within a quartz tube. The precursor aerosol was generated in a 100 mL bubbler by a nebuliser, which consisted of an ultrasonic actuator (PIFCO-HEALTH, operating frequency of 40 kHz and power of 25 W) and a plastic basin that was filled with de-ionised water. The precursor aerosol was carried to the reactor using nitrogen gas (99 %, BOC) flow, controlled by a flowmeter (CT Platon) *via* PTFE tubing, a glass bypass through a brass baffle (to generate a laminar flow), where it entered between the two plates. The reactor waste gas left through an exhaust. The flow of nitrogen gas was continued until the reactor temperature was reading at or below 30°C to prevent oxide formation. The reactor was thoroughly cleaned between each deposition, to maintain a fair test.

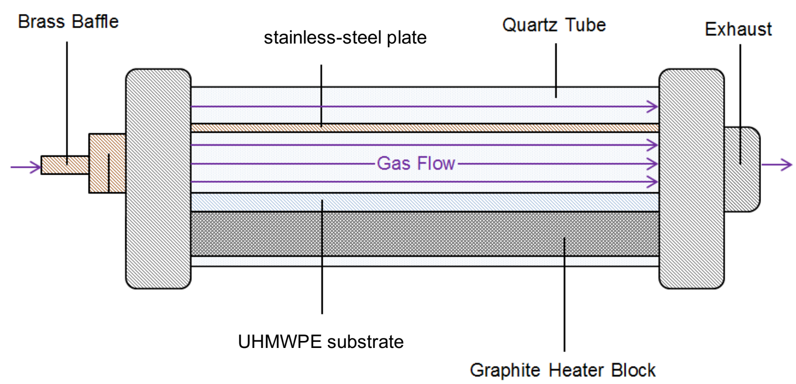

Figure S1 an illustration of the reactor set-up used for AACVD depositions (not to scale).

Thermal Analysis of copper precursor solution

No initial mass loss shoulder was observed as there are no complexed water molecules. First and only mass loss begins at 110°C, and accounts for 61% reduction in mass (55% mass loss expected if copper (II) oxide is formed), with a clean, single-step decomposition. A large peak in the DSC occurs at 133°C, which is used as an estimate for the decomposition temperature of the precursor solution. This is the lowest decomposition temperature of all the precursors tested and shows promise for use as a precursor to low temperature deposition of copper metal.

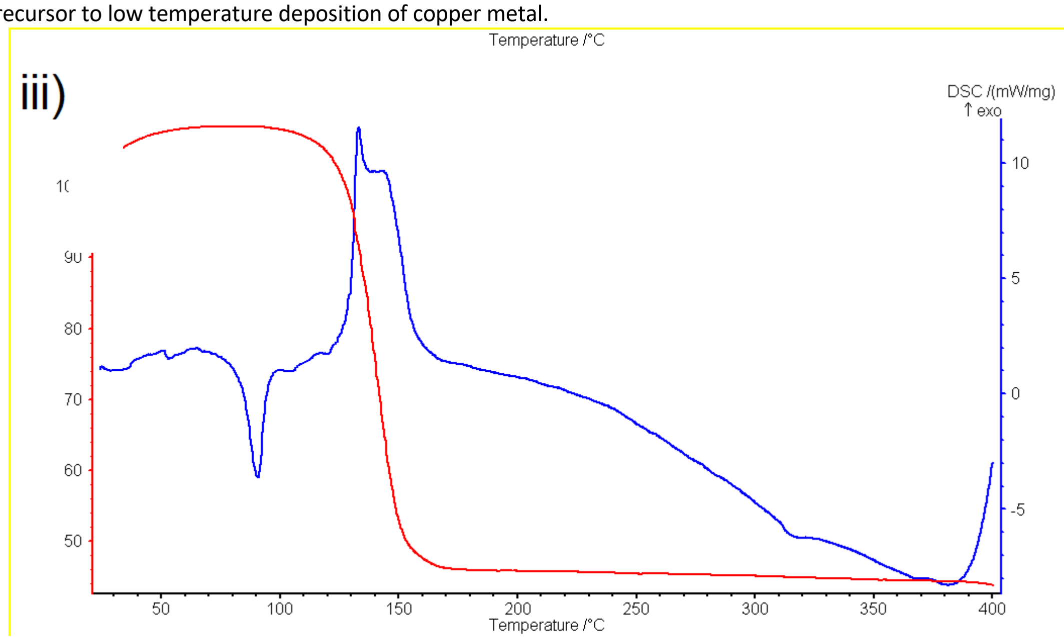

Figure S2 TGA (red) and DSC (blue) profiles of precursor solution.

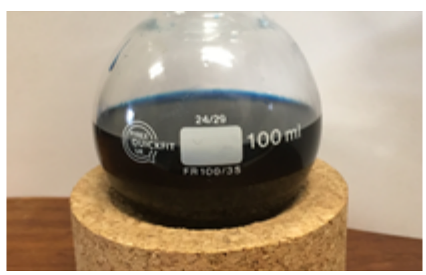

Figure S3 an example of the copper precursor solution used to deposit copper metal films *via* AACVD.

Thermal Analysis of commercially available copper salts

The TGA/DSC of commercially available copper salts: copper (II) nitrate trihydrate and copper (II) formate tetrahydrate (Figure S3) were measured and were not shown to completely decompose until much higher temperatures than any of the precursor solution.

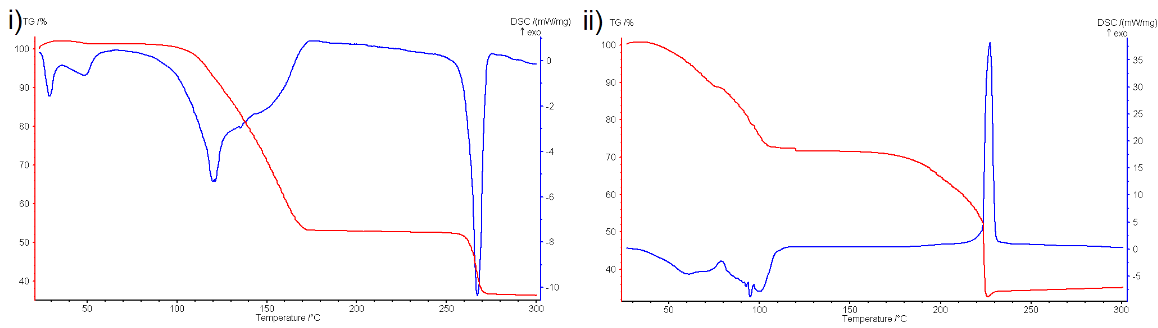

Figure S4 TGA (red) and DSC (blue) profiles of i) copper (II) nitrate trihydrate and ii) copper (II) formate tetrahydrate.

Tensile testing of the untreated and remelted UHMWPE

Table S1 ultimate tensile stress, stress at 100 % strain, stress at 300 % strain Young's modulus and elongation at break of untreated and remelted UHMWPE.

	UTS/MPa	stress at 100 % strain/MPa	stress at 300 % strain/MPa	young's modulus/MPa	elongation at break/%
UHMWPE (untreated)	28.9 ± 1.5	21.6 ± 1.9	27.5 ± 1.3	457 + 34	380 ± 14
UHMWPE (remelted)	23.3 ± 2.1	18.1 ± 0.2	23.8 ± 1.9	442 ± 36	382 ± 27

Live and dead assay

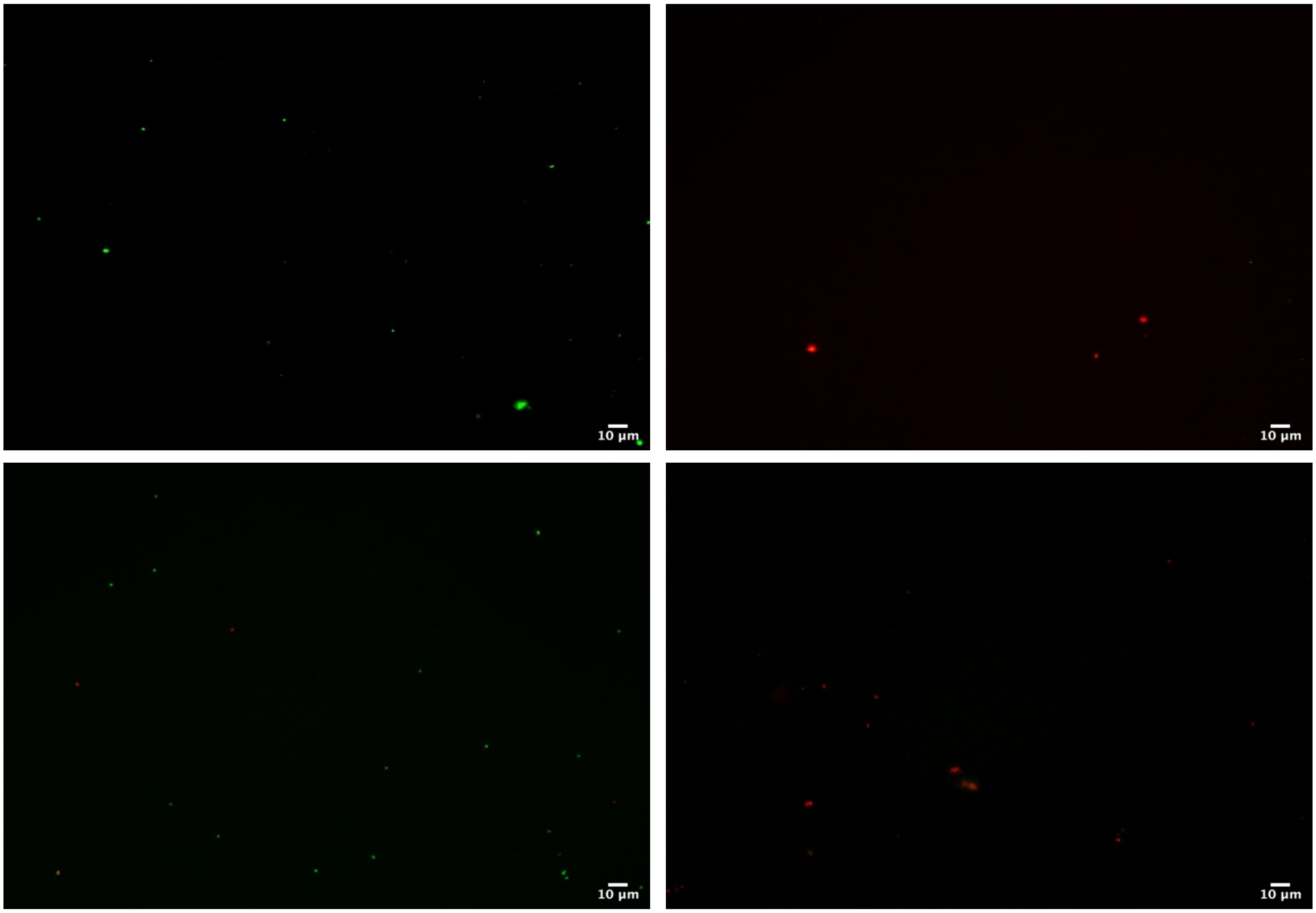

Figure S5 Fluorescence images of bacteria adhere on both control (untreated UHMWPE) and Cu-coated UHMWPE. i) adhere live (green) *E. coli* on Control (untreated UHMWPE) surface; ii) adhere dead (red) *E. coli* on Cu-coated UHMWPE; iii) adhere live *S. aureus* on control sample; iv) adhere dead *S. aureus* on Cu-coated UHMWPE.