

## Supplementary information

### **Mercapto adhesion layer by low pressure PECVD**

The experiment was carried out in a computer controlled PECVD reactor Europlasma, model CD300 (Oudenaarde, Ghent, Belgium). An aluminium vacuum chamber, connected to a Dressler's CESAR 136 RF power source (Munsterau, Stolberg, Germany) with an operating frequency of 13.56 MHz with an automated match-box was used. The chamber details are described elsewhere. The Zeonor slides were cleaned with dry air and loaded at a floating electrode and the input power was fixed at 14 Watts. The chamber was pumped down to a base pressure of 20 mTorr. Prior to the deposition, plasma cleaning and activation was carried out using argon (50sccm) + oxygen (50sccm) mix plasma (250 Watts RF power). After three minutes, the oxygen flow was closed and the RF power reduced to 14Watts. Liquid MPS precursor is stored in a KF25 closed nipple connected through a needle valve to the chamber. As the vapor pressure of MPS is less than 10 Torr at 100°C, the MPS container was heated at 80°C and to prevent condensation of MPS in pipelines, the stainless steel supply lines from source to vacuum chamber were also heated at 80°C through a temperature controlled heating tape.

### **Atmospheric Pressure Linear Field Jet (APLFJ) Source**

The linear field jet is constructed of a 100 mm glass tube, inner diameter 2mm and outer diameter 4 mm. The concentric outer electrodes are made of copper tape. The driven electrode is 20 mm in length. The grounded electrode is 10 mm in length and is terminated at 2 mm from the output end of the tube. The two electrodes are spaced 10 mm apart. The high voltage power supply causes the gas to break down within the central core of the glass capillary, generating an external plume of plasma radicals and excited species which interact with the substrate. Deposition precursors are introduced into a conical flask. An external ultrasonic (Asia mist, frequency 1.7 MHz) nebuliser is used to generate cold precursor aerosols within the flask.

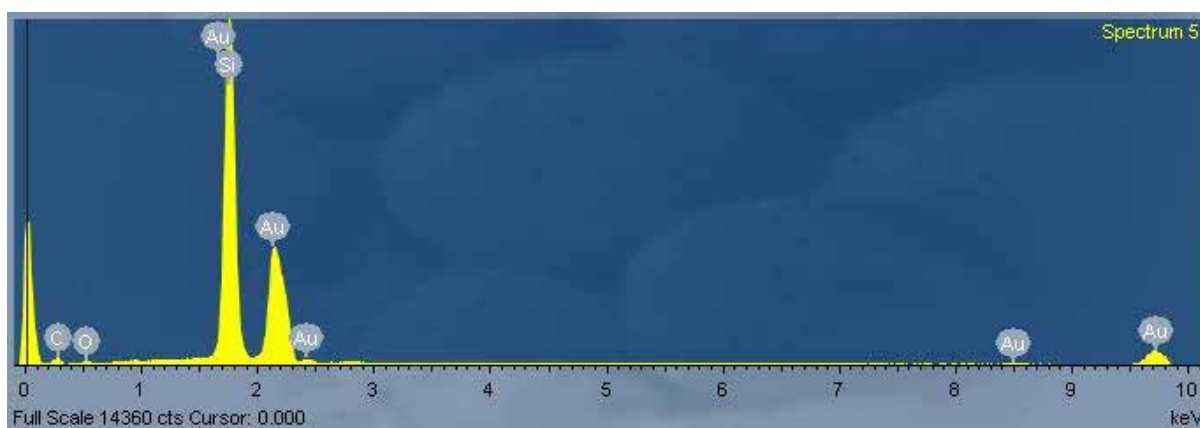
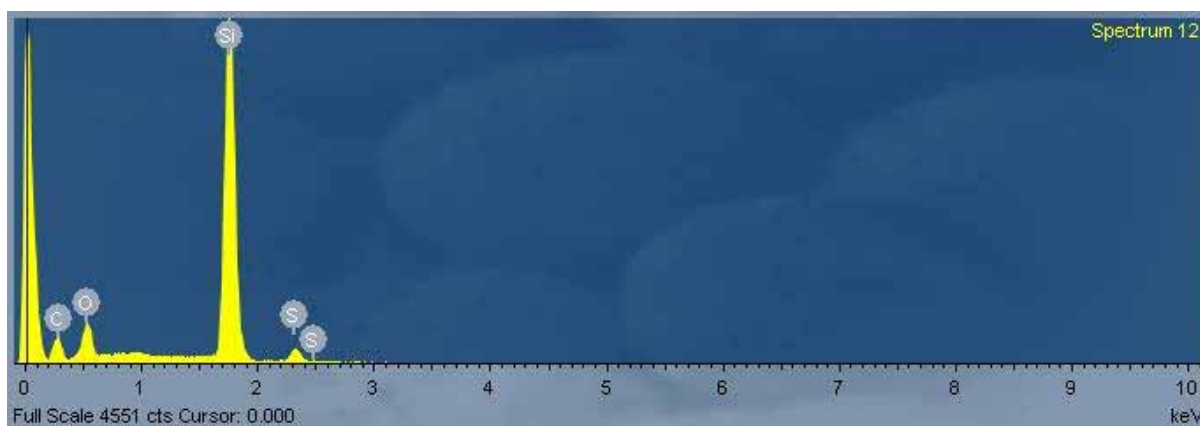
The primary feed gas flow into the linear field jet is maintained through mass flow controller MFC 1. The flow can be continuously varied from 0 - 10,000 standard cubic centimetres per minute (sccm). A secondary flow is introduced into the conical flask through MFC 2 (0 - 500 sccm). Through- out, helium gas was used as both the primary and secondary flow gases. In the case of ultrasonic nebulisation, the secondary gas was allowed to flow through the aerosol mist and into the primary flow once all of the colloid was nebulised in the conical flask. The total volumetric flow of added precursors is determined by the volume of liquid introduced into the flask, the container size and the secondary flow rate. For all of the experiments involving nanoparticle deposition, the initial volume of colloid was 2 mL. The electrical diagnostics consisted of a high voltage probe on the driven electrode together with a Rogowski coil on the ground path to measure the power coupling through a real time LabVIEW virtual instrument.

It was found that operation of the discharge was extremely sensitive to variations in the applied voltage when aerosols were introduced into the plasma volume. In the case where a low voltage (or voltage modulation) was used, the plasma periodically extinguished or did not strike at all. If the voltage was raised above a certain value then spark formation occurred. Therefore, in order to maintain similar discharge conditions across each of the depositions, a common value for each was found to be a drive voltage of 8 kV pk-pk, with full modulation, corresponding to a power input density of approximately  $23 \text{ Wcm}^{-3}$ , which was determined by evaluating the power coupled into the discharge volume. The deposition substrate is mounted vertically on a manually controlled x-y stage which is positioned at varying distances from the plasma exit plume. The depositions were performed using 40 nm and 80 nm spherical gold nanoparticle colloids. Both mechanical and ultrasonic nebulisation methods were used to inject aerosols into the plasma jet depending on the surface modification being performed.

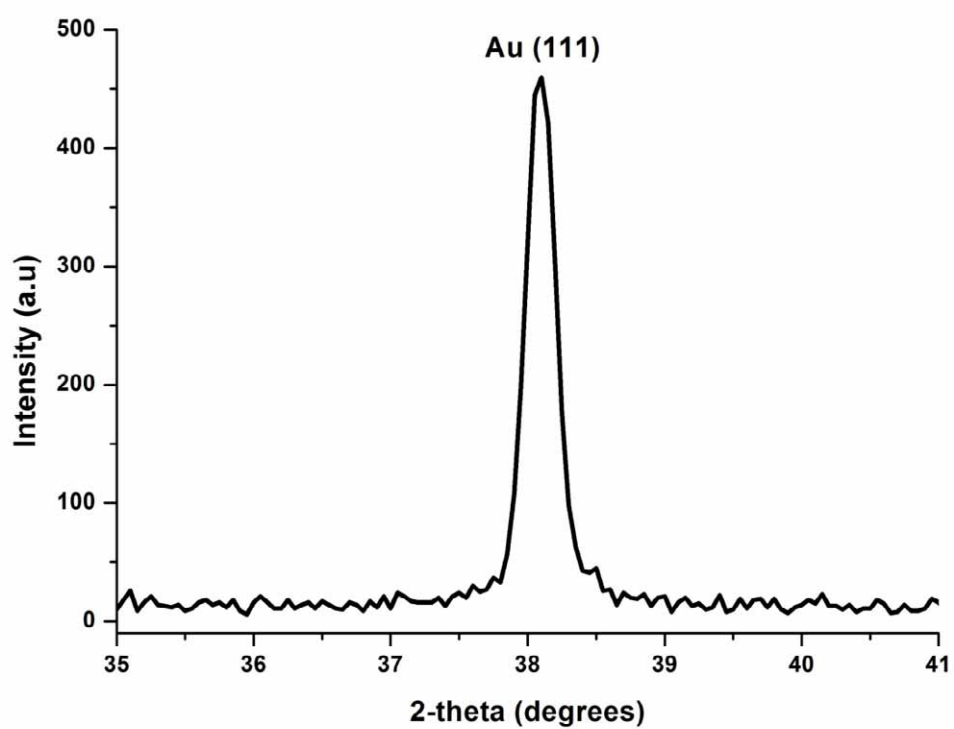
### X-ray photo electron spectroscopy (XPS)

The XPS data were collected on a Kratos Axis UltraDLD equipped with a hemispherical electron energy analyzer. Spectra were excited using monochromatic Al K $\alpha$  X-rays (1486.69 eV) with the X-ray source operating at 100 W. This instrument illuminates a large area on the surface and then using hybrid magnetic and electrostatic lenses collects photoelectrons from a desired location on the surface. In this case the analysis area was a 220 by 220 micron spot. The measurements were carried out in a normal emission geometry. A charge neutralization system was used to alleviate sample charge buildup, resulting in a shift of approximately 3 eV to lower binding energy. Survey scans were collected with 160 eV pass energy, whilst core level scans were collected with pass energy of 20 eV. The analysis chamber was at pressures in the 10<sup>-9</sup> Torr range throughout the data collection. Data analysis was performed using CasaXPS ([www.casaXPS.com](http://www.casaXPS.com)). Shirley backgrounds were used in the peak fitting. Quantification of survey scans utilised relative sensitivity factors supplied with the instrument. Core level data were fitted using Gaussian-Lorentzian peaks (30 % Lorentzian). The binding energy scale was corrected for the neutraliser shift by using the C 1s signal from saturated hydrocarbon at 285.0 eV as an internal standard.

### EDAX spectra



**Supplementary Figure 1.** (Top)EDAX spectrum of mercapto silane coating on silicon and (Bottom) EDAX spectrum of gold nanoparticles on mercapto silane coated Silicon



**Supplementary Figure 2.** X ray diffraction spectrum of gold nanoparticles deposited by aerosol assisted atmospheric jet plasma.