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Electronic Supplementary Information: Probing a dip-coated layer of organic molecules by aerosol nanoparticles sensor with sub-100 nm resolution based on surface-enhanced Raman scattering

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Configuration of electrostatic spray system

An electrostatic spray was designed and fabricated to generate and deposit Ag particles. Deposition experiments were conducted in a stainless (SUS 304) chamber. We designed and controlled the electric field between a spray nozzle and a substrate surface so that charged particles can move in straight motion from the tip of the nozzle to the surface. When electrostatic effect is dominant, deposition velocity, V_d of charged particles can be described by[1]

$$V_d = q_p E B \quad (1)$$

where q_p and E are a charge of a particle and external electric field, respectively; B the mechanical mobility. Therefore, the deposition performance of the developed spray system can be determined by the electric field on a substrate surface.

The surface electric fields were numerically calculated by a commercial simulation software (COMSOL Multiphysics 4.3). Fig. 1 shows the initial conditions for calculation, the distribution of electric fields and plots of surface electric fields on a surface of either silicon or glass substrate. The plots (Fig. 1c) were obtained from the calculated results. From these results, the surface electric fields are comparable, because the average fields for silicon and glass substrate are 2.6×10^4 and 2.5×10^4 V/m, respectively. Since the electrical properties of substrates do not affect the spray condition, the ratio of deposition velocity on silicon substrate to that on glass substrate yield 1.04, meaning that deposition behaviors of particles are similar between the substrates.

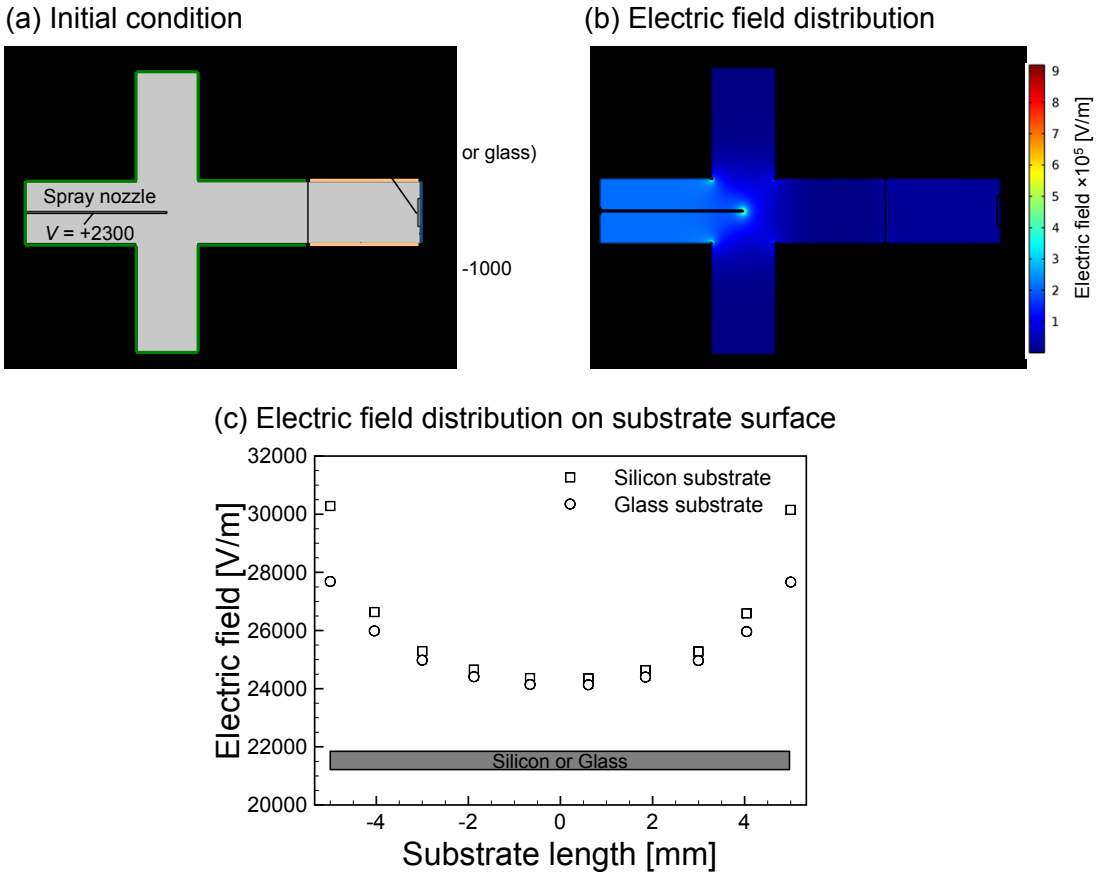

Fig. 1. (a) Initial condition for numerical simulation: Applied voltage, *V*. (b) Electric field distributions in the case of silicon substrate. (c) Surface electric fields on silicon and glass substrate

References

(1) W. C. Hinds, Aerosol technology: properties, behavior, and measurement of airborne particles, 2nd ed., John Wiley & Sons, 1999.