Supplemental information for

Design and performance evaluation of a laboratory-made 200 nm precut electrical cascade impactor

Jangseop Han[1+], Joohee Seo[1+], Dongho Park[2], Junho Hyun[3], Jungho Hwang[1,3*]

[1] Department of Mechanical Engineering, Yonsei University, Seoul, 03722, Republic of Korea
[2]Department Korea Institute of Industrial Technology (KITECH), 31056, Republic of Korea
[3] Graduate program of Clean Technology, Yonsei University, Seoul, 03722, Republic of Korea

INFORMATION AVAILABLE

This section provides the following information:

1. Performance test of lab-made electrometer;
2. Structure diagram with geometry dimension for the corona charger;
3. Size distributions of the monodisperse Ag and PSL particles;
4. Structure of the cylindrical ion trap.

1. Performance of lab-made electrometer

Figure S1 shows a circuit diagram of the electrometer. We used a three-stage amplifier circuit to obtain a stable output signal with a total amplification rate of 1.69×10^{12} V/A: (first) current-to-voltage converter, (second) inverting amplifier, (third) noninverting amplifier. The feedback capacitors (C5, C9) and RC low-pass filters (R3 and C7, R6 and C11) reduce the high-frequency noise and prevent the amplifier output from oscillating. In addition, a power-supply filtering scheme is adopted in the amplifier power rails by adding 100 nF capacitors. Commercially available low-cost high-impedance operational amplifiers are used: LMC662 featuring ultralow input bias current (2 fA maximum) and low-offset voltage drift (1.3 μV/°C).

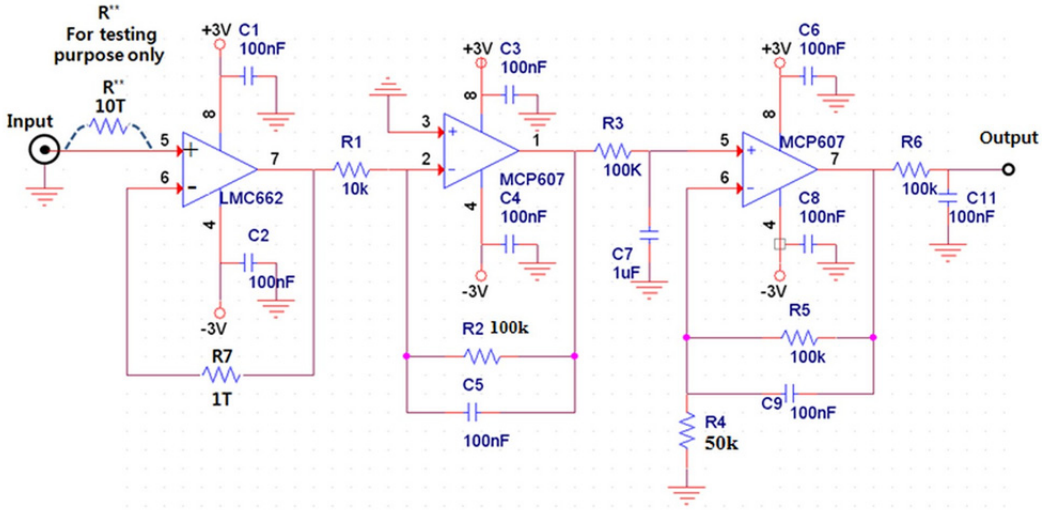

Fig. S1. Circuit diagram of electrometer.

2. Structure diagram with geometry dimension for the corona charger

The structure diagram of the corona charger with geometry dimensions is shown below.

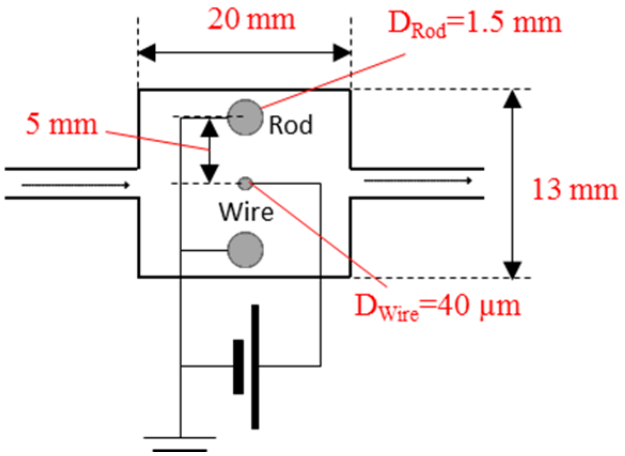

Fig. S2. Wire-to-rod type corona charger.

3. Size distribution of the monodisperse Ag and PSL particles

The following figures show size distributions of the generated Ag particles (original) and PSL particles (DMA-classified). The geometric standard deviations are 1.19, 1.21, 1.11, and 1.12, respectively, for 10nm, 100nm, 220nm, and 370nm.

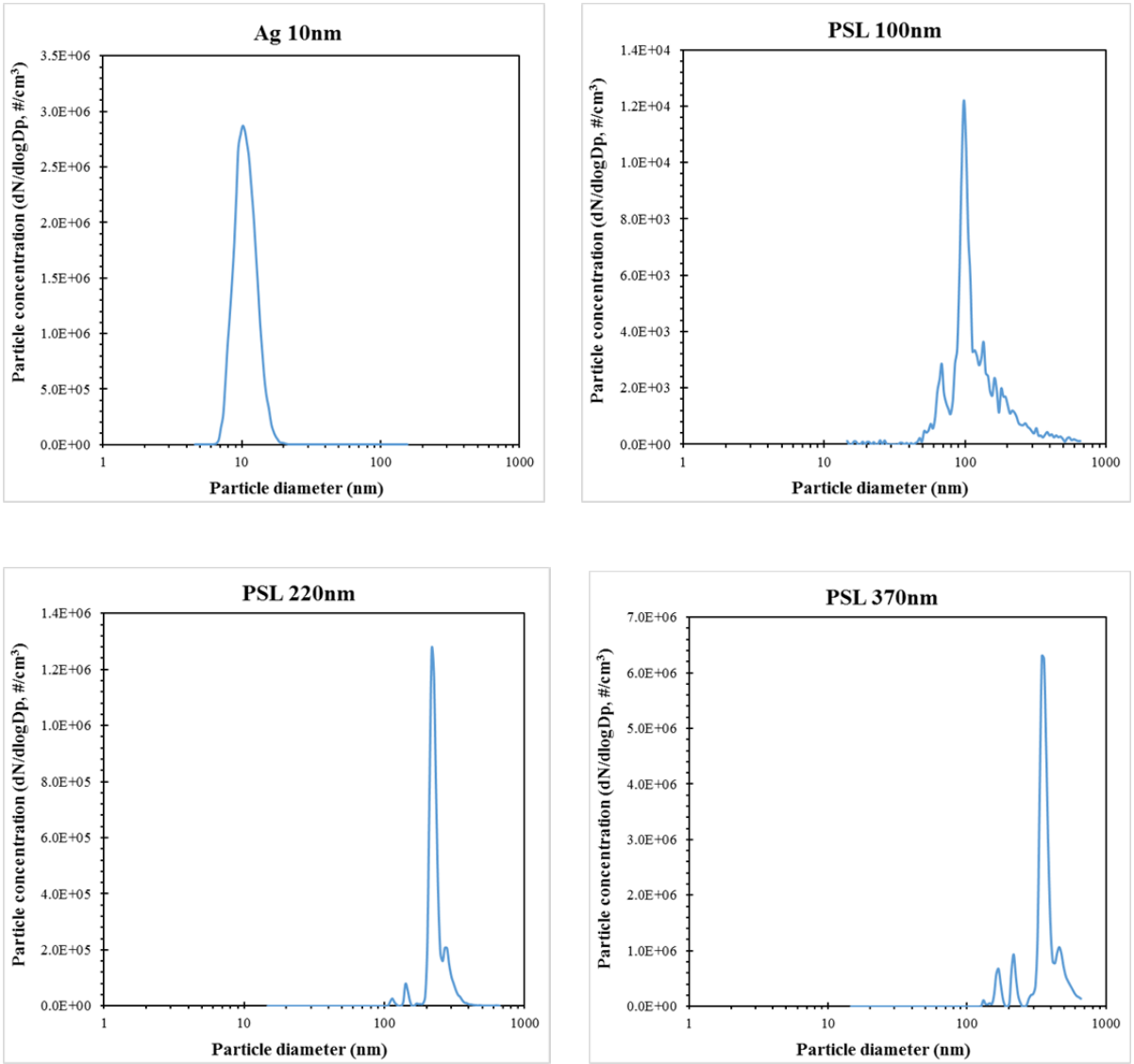

Fig. S3. Size distribution of the monodisperse Ag and PSL particles.

4. Structure of the cylindrical ion trap

The ion trap consists of an outer cylinder and an inner rod, and they are insulated from each other. When a voltage is applied to the inner rod while the cylinder is grounded, electric filed is formed between the cylinder and the inner rod. The gaseous ions leaving the charger that could affect current signal of ECI were removed in the outer cylinder and the inner rod, depending on the polarity of the ions. The figures and geometry dimensions of the ion trap are shown below.

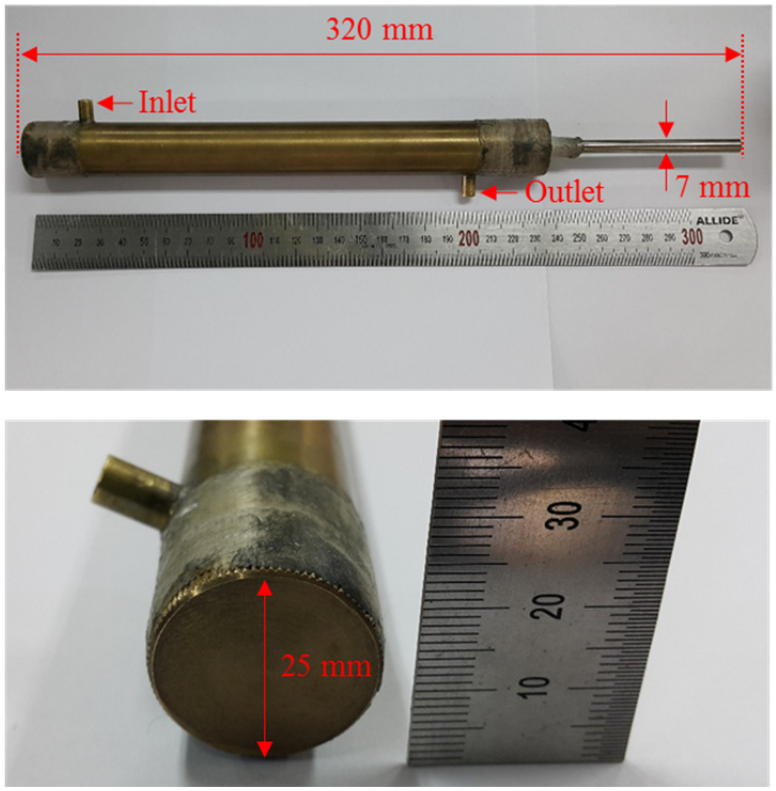

Fig. S4. Cylindrical ion trap.