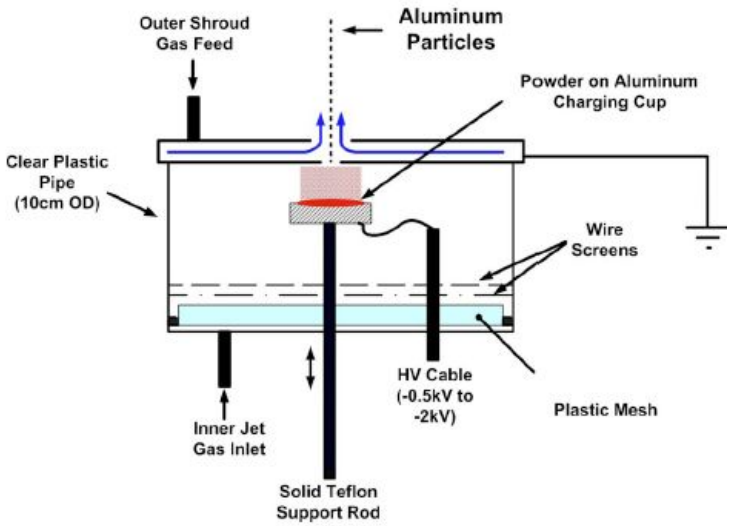
ELECTROSTATIC AEROSOL GENERATOR : Standard operating procedure

Rev. 08/02/2013

Description

The electrostatic aerosol generator (ESAG) utilizes electrostatic charging/discharging of the aluminum particles to generate a particle stream. The conductive metal particles pick up a charge on the charging cup and they are repelled by the charge on the cup upwards and into the carrier gas stream. The airborne particles can either exit the ESAG through a small hole ~0.7 mm in the top aluminum plate or hit the upper grounded plate, become neutralized, and drop back onto the charging plate. The gap between the charging cup and the upper grounded plate is 1.0 cm. The particles exit the ESAG entrained in the vertically rising carrier gas stream. The number density in the particle jet is adjusted by the voltage applied to the ESAG electrodes.



The AC variable transformer (Variac) supplies voltage to the DC power supply, producing high voltage on the output of the DC power supply. The Variac voltage can be changed in the range 0-120 V that corresponds to the DC voltage in the range from 0 to 100 kV. The correspondence between these voltages is tabulated.

Before loading powder:

1) Wear the goggles, lab coat and gloves when operating the setup.
2) Ensure that DC power supply is turned off.
3) Ensure that the valves in the carrier and shroud gas lines are shut off, and no gas entrains the ESAG.
4) Prepare the powder to load into the ESAG.

Loading Powder

1) Unclamp the ESAG from the holding plate to which it is attached, and carefully supporting the bottom part of the ESAG, remove the feeder. Keep the ESAG in a vertical position so that possible powder residue does not contaminate the lab area.
2) Remove the charging cup.

3) If necessary, discard the powder residue on the cup and clean the internal area of the feeder with the dust cleaner.
4) Load with the spatula the necessary amount of powder (typically, several layers of powder) in the aluminum charging cup and spread it uniformly on the cup surface.
5) Place the charging cup in the ESAG.
6) Holding the ESAG vertically, attach it with the clamps to the holding plate.
7) Adjust the gap between the electrodes (the cup and the upper plate), if necessary, by moving the support rod up or down. Ensure that the proper gap between electrodes exists, and they don't contact each other.

Before starting the ESAG

1) Ensure the proper wire connections and grounding.
   NOTE: High voltage is used in the device, and it is critical that all the wires are connected and secured properly, and there are no loose contacts or hanging wires. The neglect of these requirements can lead to electrical shock and damage.

Starting the ESAG:

1) Turn on the high voltage power supply.
2) Open the carrier gas and the shroud gas line valves.
3) Adjust the flow rates of the carrier and shroud gas, using the flow meters and knobs on the flow control panel.
4) Sometimes, when the gap between electrodes is too small, the spark between electrodes is created. This spark is visible and produces characteristic sound. Ensure that no spark exists between electrodes. Otherwise, turn off the power supply, and increase the gap between electrodes by moving down the Teflon Support Rod.

During the run:

1) Monitor the voltage supplied to ESAG according to the needs of the experiment.
2) Monitor the carrier and gas flow rates according to the needs of the experiment.

Shutting off the ESAG:

1) Turn off the powder supply using the button.
2) Unplug the power supply.
3) Close the valves in the carrier gas and shroud gas lines.

Unloading powder:

1) Unclamp the ESAG from the plate to which it is attached, and carefully supporting the bottom part of the ESAG, remove the feeder. Keep the ESAG in a vertical position so that possible powder residue does not contaminate the lab area.
2) Remove the charging cup.
3) Discard the powder residue on the cup and clean the internal area of the feeder with the dust cleaner.
4) Place the charging cup on the cup holder.
5) Holding the ESAG vertically, attach it with the clamps to the holder plate.