### MME Standard Operating Procedure (SOP)

<table>
<thead>
<tr>
<th><strong>Name</strong></th>
<th>Huys ESD Machine #2</th>
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</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>R&amp;D Variable Parameters ESD Machine</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>E3-2107 “Welding Lab”</td>
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<tr>
<td><strong>SOP Creation Date</strong></td>
<td>2015-3-31</td>
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<tr>
<td><strong>SOP Created By</strong></td>
<td>Foss Jiao, Dominic Leung</td>
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<tr>
<td><strong>SOP Revision Date</strong></td>
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<tr>
<td><strong>SOP Revised By</strong></td>
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<tr>
<td><strong>SOP Location</strong></td>
<td>inv.mme.uwaterloo.ca</td>
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<tr>
<td><strong>Manual Location</strong></td>
<td>E3-2107 “Welding Lab”</td>
</tr>
<tr>
<td><strong>Equipment Owner</strong></td>
<td>Professor Norman Zhou (x36095) &amp; Huys Industries</td>
</tr>
<tr>
<td><strong>Authorized Trainers</strong></td>
<td>Joyce Koo, Foss Jiao, Stephen Peterkin and Dominic Leung</td>
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<tr>
<td><strong>Support Technicians</strong></td>
<td>Dominic Leung</td>
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#### Significant Hazards

- **Light**
  - Weak UV radiation from the electrode sparks
  - Weak UV radiation from red hot metals
- **Burns**
  - Operating electrode tips reach red hot temperatures
- **Fumes**
  - Some metals may be rapidly oxidized or vaporized during deposition forming toxic vapors
- **Vibrations**
  - Vibrations from the applicator would cause bodily fatigue after an extended period of operation
- **Noise**
  - Extended use of depending on the applicator can cause hearing damage

#### Administrative Controls

- Scheduling of ESD depositions shall be scheduled amongst the authorized personnel
- Only authorized personnel shall operate, maintain or service the ESD Machine
- Reduce extended depositions to prevent fatigue, eye damage and hearing damage
- Always run the lab ventilation fan when depositing

#### Engineering Controls

- Equipment design prevents excess large short circuit discharges while the applicator is not rotating / vibrating
- Equipment discharge and resistance requirements prevents electrocution during operation
### PPE Required

Typical operating procedures and papers on ESD stress that there are little to no required PPE requirements

- **Eye protection is required during ESD**
  - Clear safety glasses are the minimum to spectate the ESD equipment
  - Operators should use tinted safety glasses or brazing goggles during extended ESD use, as the bright sparks and weak UV radiation may strain eyes
  - Shades beyond 5 may impair vision during deposition and are not recommended
- **Gloves are to be worn to protect from sparks during deposition as well as prevent burns from handling hot substrates and electrodes post deposition**
- **Long sleeves or lab coats are required to protect wrists and arms from sparks and burns resulting from deposition and contact with hot substrates / electrodes**
- **Hearing protection can be used if loud applicators are being utilized for extended periods of time**

### Relevant Standards and Codes

- **none**

### Relevant MSDS

All MSDSs can be found at [msds.mme.uwaterloo.ca](http://msds.mme.uwaterloo.ca)

- Argon Compressed gas
- LECO diamond spray

### Accident Procedure

- **All accidents are to be reposted to the supervisor as soon as possible**
  - Treat minor incidents with First Aid kits or contact UW Health services 599-888-4096 x84096
  - Contact Dr. Joyce Koo or Professor Norman Zhou
  - Complete incident report
- **In the event of serious injury / illness Call 911**
  - Also contact campus police services 519-888-4911 or x22222
  - Complete incident report

### Emergency Shutdown Procedure

- **Injury**
  - Turn off the Huys ESD Machine using the power ON / OFF switch
  - Follow accident procedure
  - Complete incident report
- **Fire**
  - Turn off the Huys ESD machine if safe to do so
    - Disconnect the power to the machine if safe to do so and necessary
    - Turn off the exhaust fan to the lab if safe to do so
    - Exit the area and assemble outside as stated in the Building Emergency Plan
    - Access fire extinguisher if the fire is small enough
    - Fire extinguisher located on the wall in the corridor outside the lab
    - Activate wall mounted fire alarms
    - Report any information about the fire to the UW Police and Fire Department
Huys ESD Machine #2

- LCD Display Unit
- Keypad
- Power Indicator
- ESD Electrode
- - ve Terminal
- +ve Terminal

Huys Applicator

- Spindle Speed Control
- Operation ON/OFF
- Applicator Speed Control
- FWD/Off/REV Switch
Pre-start Checklist

- Ensure that the lab ventilation fan is on
- Ensure that the door to the lab is closed to protect passers by
- Ensure that the deposition area is clear of flammable media and clutter
- Check the operating condition of the equipment
  - Check the machine power, applicator and grounding cables for fraying and damage
- Do appropriate PPE as listed in the operating procedure
  - Ensure that the operator will not contact the fixtures, ground, substrate or electrode while operating with bare skin
- Ensure that a power bar is securely connected to the wall outlet 15A 120V 60hz
- Ensure that the power switch of the applicator speed control is set to OFF
- Ensure the power switch of the power bar is set to OFF before the ESD machine, the spindle speed control & applicator speed control units are connected to the power bar
- Ensure the spindle unit securely sits on a bench, and is free and safe to rotate
- Ensure that the applicator speed control unit is securely mounted to a wall
- Ensure that a ground cable is securely connecting the –ve terminal of the ESD machine and the terminal of the spindle unit
- Ensure that the ESD power cable from the applicator is securely connected to the +ve terminal of the ESD machine
- Ensure that the cooling fan is operating when the power is ON
Start-up Procedure

- Attach the applicator and ground clamp before turning on the machine
- Ensure that the power bar is securely connected to the wall outlet 15A 120V 60hz
- Ensure that the ESD machine, spindle speed control unit and the applicator speed control unit power cables are securely connected to the power bar
- Attach an electrode cap, to be ESD coated, to the spindle unit
- Secure an ESD electrode into the applicator (may require the use of a hex key to the holder)

Operating Procedure

- Turn on the power bar (Ensure that the applicator speed control switch is set to OFF)
- Turn on the ESD machine. Ensure the LCD display shows a normal power up sequence
- Ensure the following ESD parameter values for normal coating conditions with the use of the keypad and LCD display units on the front panel: (Find detailed information in user manuals)
  - ARC Voltage = 5 - 45, default = 20
  - ESD Voltage = 25 - 45, default = 35
  - ESD Voltag2 = 10 - 45, default = 20
  - ARC Charge = 10 - 35, default = 25
  - ESD Charge = 10 - 45, default = 40
  - Discharge DLY = 0 - 5, default = 1
  - Recharge DLY = 0 - 5, default = 2
  - Hi Pulse = 1 – 5, default = 2
  - Lo Pulse = 0 – 5, default = 2
  - Cntrl Mode = 0 – 5, default = 1
- Ensure that the electrode cap on the spindle is rotating in a symmetrical manner. Redo the sitting if necessary
- Set the spindle speed control to desired value and ensure that the spindle is spinning freely
- Set the power switch of the applicator speed control device to the desired rotational direction, FWD or REV. The applicator should start vibration immediately.
- Begin deposition
- Adjust ESD coating parameters when needed through the keypad and LCD display units on the front panel

Shutdown Procedure

- Turn off the ESD machine
- Turn off the FWD/OFF/REV switch of the applicator speed control unit
- Carefully place the applicator where the electrode will not damage any of the equipment or fixtures (as it remains hot after deposition)
- Turn off the ON/OFF switch of the power bar

Maintenance and Repair

- Clear the dust collected on the filter screens on the side of the chassis
- Contact Dominic Leung or other trained staffs for serious problem and electrical issues