Electron Beam Evaporation
I. Mechanism:
In a vacuum environment, E-beam evaporator uses electron beam to heat a source target (put in a crucible). Then the source is evaporated around its melting point and deposited onto sample surface. Compared to traditional vacuum evaporator which use a resistor to heat whole source in crucible, E-beam evaporator just heats local area of the source to increase process efficiency and reduce contamination.

II. Operation Process
1. Check using record and turn on the touch panel

2. Check 3 parameters:
   1). Cryo Temperature : -6--7
2). Cryo Pressure (from Vacuum gauge): CH1 < E-04 Pa

3). Frequency ratio of quartz oscillator (from CRTM-6000 ; Thickness Control System): >80%

3. Open the valve of N2 gas and Vent:
   Mode Select: Semiauto → Pump Down: Stop → Vent: Start → open chamber door when pressure arrives 743 torr
4. Put samples on the sample holder (3 holders and each one can be put on 5 4-inch wafers)

* Jig rotation trial run: to check if sample holder rotates smoothly and if samples would fall off from the holder

EbeamI: speed ~20 / MANUAL RUN
* **EbeamII**: speed 50~60 / AUTO RUN \(\rightarrow\) Jig of touch panel: start

5. **Put source targets** (Max. : 4 targets, number #1~4). Use a flashlight to check if crucible can be seen as electron beam is lighted up  
   * Al target is in target holder #1 of EbeamI (not allowable for EbeamII)

6. **Pump Down**: Start \(\rightarrow\) low vacuum (743 ~1E-02 torr) : Rotary pump & RV \(\rightarrow\) high vacuum (<1E-02 torr) : Cryo pump & MV  
   * Min. vacuum for deposition process: **5E-05 torr**, but it’s better to start deposition at pressure **5E-06~2E-06 torr**

**CH2 & CH3** : chamber pressure (CH2: low vacuum gauge / CH3: high vacuum gauge)
7. Pump Down : Stop → Semiauto : Stop → Mode Select: **Auto DEPO**

8. **Deposition rate & film thickness setting** from CRTM-6000
   Ex: Al target (No. 01), deposition rate 4Å/s, film thickness 4kÅ
   * Recommendation of deposition rate: 0.5~2Å/s

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**MENU → PROGRAM MENU** → DEPOSITION PROGRAM → page 2/6:
**deposition rate & film thickness** → page 4/6: check target density & Z-ratio

**MENU → PROCESS PROGRAM** → page 1/5: source target No.

**MENU → DATA DISPLAY**
9. **Auto Depo**

**Auto Depo**: Start → turn on **power supply** → High voltage: **REMOTE** →

Auto DEPO Ready: **Start** → **Hearth**  定位確認

- Turn on Power Supply
- High Voltage: **REMOTE**
10. When the status is **DEPO**, adjust electron beam position (sweep 0.5~1) and start deposition process

11. **DEPO** process done → **Cool** 10mins → **Auto DEPO Ready**: **Stop**
   * Composite films (Ex: Al + Ti) or the very thick film needs to deposit many times (Ex: 1μm total thickness): When one process is done, you can change source target, update the setting of CRTM-6000 and then re-start the Auto DEPO (**repeat the step 9~11**)

12. **Vent** and take out samples & crucibles:
   - **Main page** → **Mode Select**: **Semiauto** → **Vent**: Start → open chamber door when pressure arrives **743 torr**

13. **Clean chamber** and **Pump down**

14. When RP & RV are switched to CP & MV, **turned off the touch panel** and fill in the using record.