Characteristics and Evaluation of Crystals

Er. Somesh Kr. Malhotra
Assistant Professor
ECE Department,UIET

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- Routine Evaluation of crystals involves
  - Testing their Resistivity
  - Evaluation of crystal perfection
  - Examining their mechanical properties such as size and mass
- Other less routine evaluation includes measuring the crystal
  - Oxygen
  - Carbon
  - And heavy metal content.

- The evaluation of heavy metal content are made by minority carrier measurement or neutron activation analysis.
- After growth, the crystal is usually weighed , then inspected visually.
- Gross crystalline imperfection such as twinning are aparent to the unaided eye.
- Section of the ingot containing such defects are cut from the boule , as are section of the boule that are irregular shaped and undersized.
- Total silicon loss can equal to 50% at this step.

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- Next the but or tang end of the ingot,or a slice cut from that position, is prefentially etched to reveal defects such as dislocations.
- A common etchent is **Sirtl's etch**, which i8s one/one mixture of HF acid(49%) and five molar chromic acid.
- **Cracks** can be detected by a method that uses ultrasonic waves.

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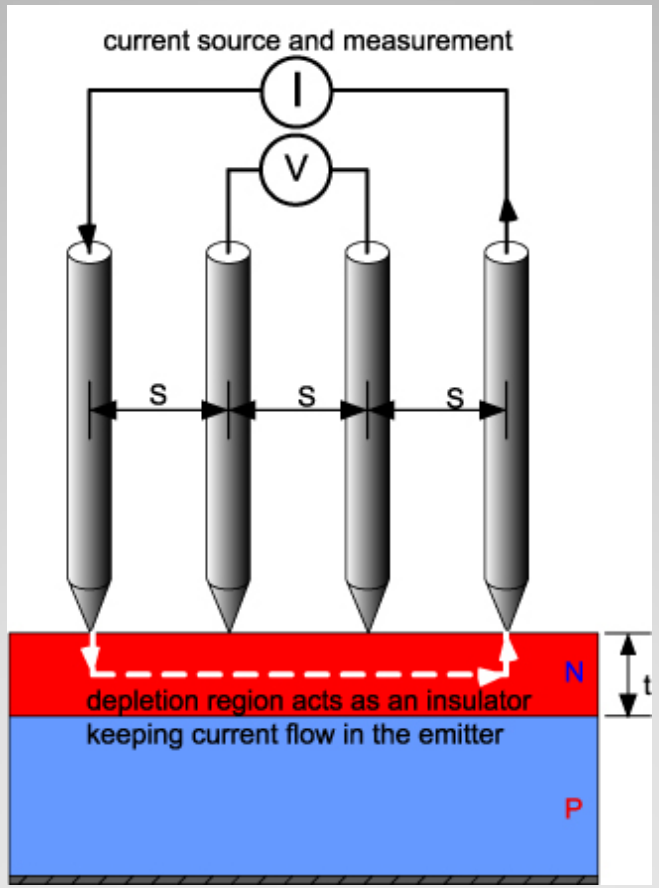
- **Resistivity** measurement are made on the flat end of the crystal by **four-point probe technique.**
- Current I (mA) is passed through the outer probes and voltage V(mV) measured between the inner probes (as shown in Fig) .
- The measured resistance (V/I) is converted to resistivity (Ω/cm) using the formula.

$$P=(V/I)2\Pi S$$

- Where S is the probe spacing in cm.
- Measurement can be reproduced to +/-2% if care is taken in selecting instrumentation ,probe pressure and current levels.



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