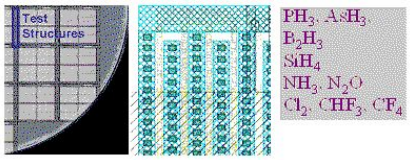
4.4 Summary

4.4.1 Summary to: 4. Getting Started

- Semiconductor technology happens in factories. They need special materials, "reticles" (= structures), "know-how" and huge amoundt of money (= capital) as major inputs
  - It's always about money! Only mass production will recover large investments.
  - The materials side always contains semiconductor substrates ("wafers") and often very dangerous special "raw" materials.
  - A number tells it all: **500 - 1.000** wafers /day are processed in a large **Si** "wafer fab"



- Three big steps to **Si** wafers
  - **Si** single crystal growth is done by "Czochralski process" (**CZ**).
  - Dislocation-free crystals are possible but "bulk microdefects" and impurities cannot be totally avoided.
  - Nearly perfect **300 mm** wafers are standard.

Sand (SiO_2)	⇒	**Metallurgical Si**
Metallurgical Si	⇒	**clean (doped) poly-Si.**
Poly-Si	⇒	**Single crystal / wafer**

- Growing single crystals of compound semiconductors is far more difficult than for elemental semiconductors
  - Precise stoichiometry is important
  - Vapor pressures if the constituents at the melting point might be very different
  - New kinds of defects might be encountered
  - Polytypie might be encountered

GaAs:
150 mm wafers, encapsulation technique, disl. density (10^3 - 10^6) cm^{-2}

GaP, **InP**
as **GaAs** but smaller and more expensive

SiC:
100 mm wafers, sublimation technique, several polytypes available, "pipe" defects

- Major techniques are
  - Encapsulated **CZ**
  - Sublimation growth

Exercise 4.4-1
All Questions to 4.

Questionnaire
Multiple Choice questions to 4.