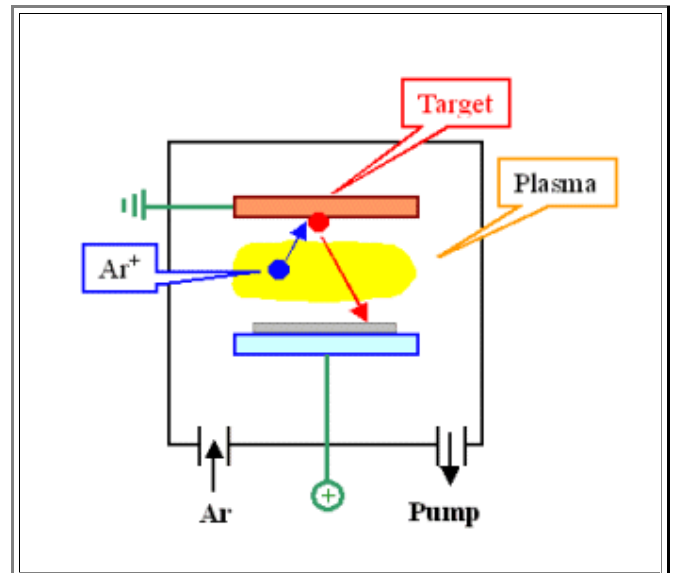


6.3.4 Summary to: 6.4 Physical Processes for Layer Deposition

Sputter Deposition

- Simple in principle: Shoot off any mixture of atom contained in a target by an ion beam produced by applying high (RF) voltage between target and Si wafer; see picture.
- Great advantage is easy deposition of mixtures of elements, e.g. Al plus traces of Cu etc.
- Disadvantage:
 1. target should be conducting; no (easy) deposition of insulators like SiO_2 . Target atoms are emitted in all directions, leading to:

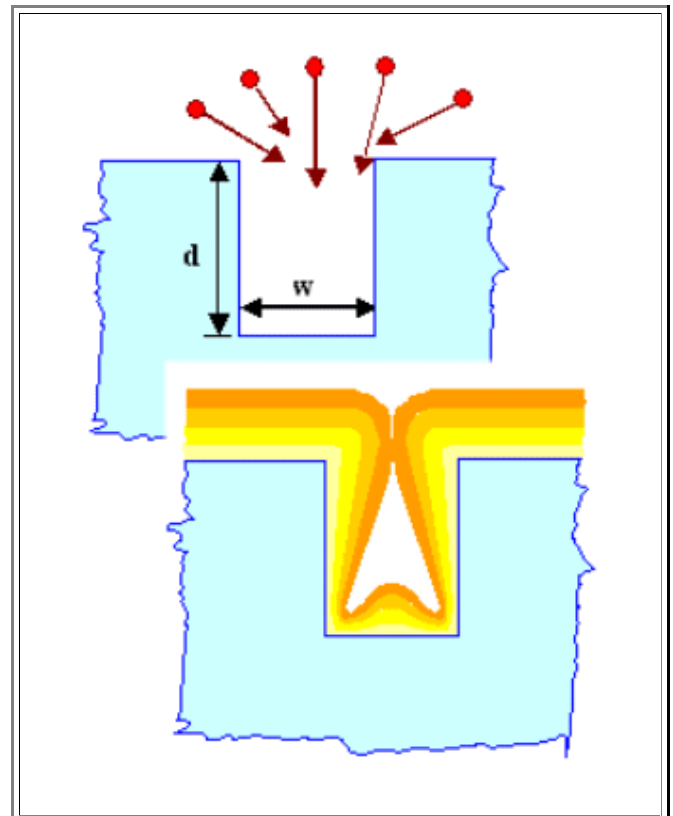


"Contact hole filling problem"

- The picture tells it all. At some point you need to go back to CVD processes.

Ion implantation. Might be considered to be a "deposition" technique but actually shoots ions into the Si target.

- The technique of choice for doping selected areas with typically B, As or P.. Depth distribution and concentrations finely adjustable in a wide range.
- Major problems:
 1. The Si crystals gets more or less destroyed; in the extreme it turns amorphous. Implantation thus always need a follow-up annealing process that changes dopant distribution by diffusion and may not be able to restore perfectness of the lattice
 2. Implanters are huge, complex and very expensive machines.



Other physical deposition techniques.

There are plenty, often quite specialized. Of special important for chip making are.

- Evaporations. Easy but very limited. Rarely used in chip production
- Spin-on techniques (for deposition the light sensitive "resist" needed for lithography)
- Molecular Beam Epitaxy (MBE);: hugely important for III-V technology.
- Galvanic techniques. Hated but used
- Many other.

Questionnaire

Multiple Choice questions to all of 6.4