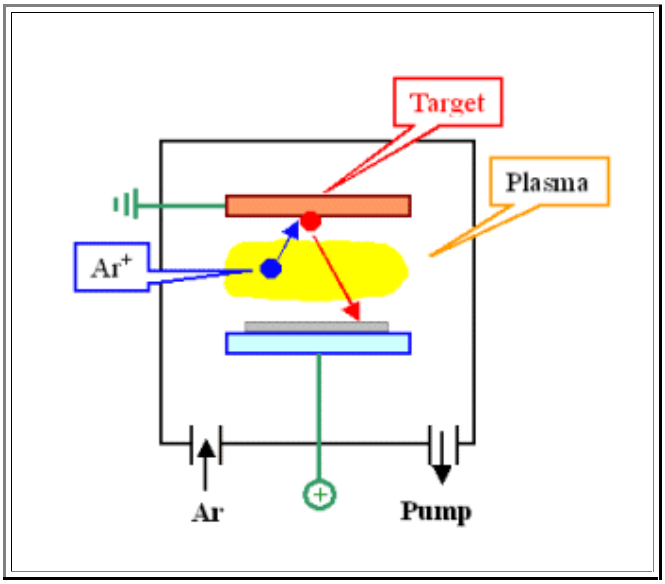
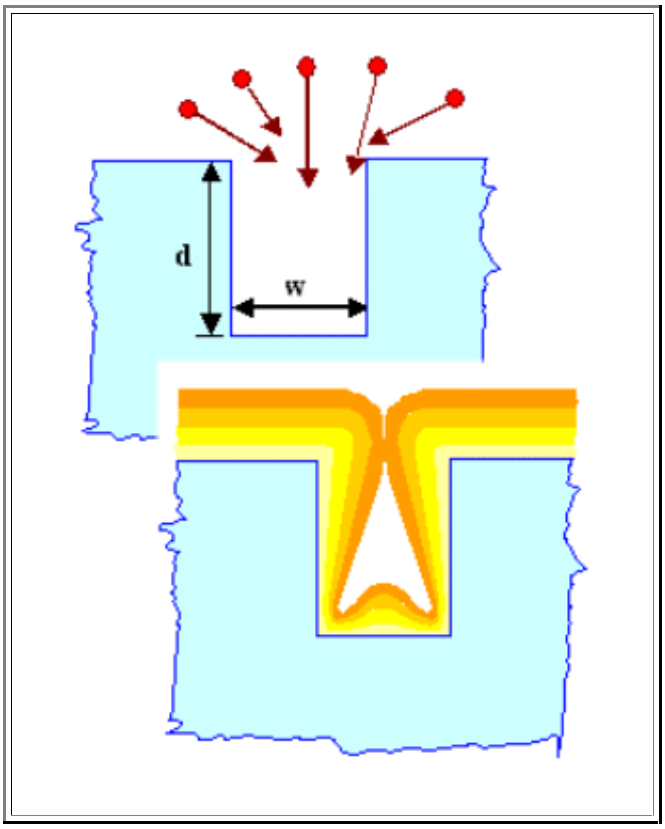
6.3.4 Summary to: 6.4 Physical Processes for Layer Deposition

- Sputter Deposition



  - Simple in principle: Shoot off any mixture of atom contained in a target be 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.

Questionaire

Multiple Choice questions to all of 6.4