3.1.2 Applications of Thin Films

Applications Outside Semiconductor Technology

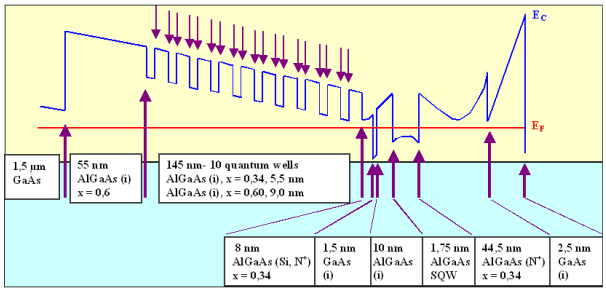
Let's first look at applications of thin films outside of semiconductor technology - so we know and then can forget it for the time being. What we have, very briefly and not exhaustively, is

Application Field	Examples
Optics	Antireflection coating; on lenses or solar cells, .. Reflection coatings for mirrors. Coatings to produce decorations (color, luster, ...), Interference filters. **CD's**, **DVD's** and upcoming **D's.** Waveguides. Photosenistive coating of "analog" film for old cameray
Chemistry	Diffusion barriers. Protection agains corrosion / oxidation. Sensors for liquid / gaseous chemicals.
Mechanics	"Hard" layers (e.g. on drill bits). Adhesion providers. Friction reduction.
Magnetics	"Hard" discs. Video / Audio tape. "***SQUIDS***"
Electricity (without semiconductors)	Insulating / conducting films; e.g. for resistors, capacitors. Piezoelectric devices

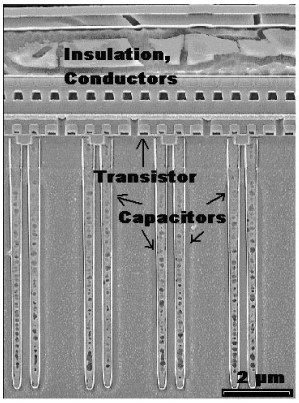
- You should know some of this stuff from experience (do your glasses have an antireflection treatment? an antiscratch layer?) or from your studies.
- For some other applications you may easily guess where thin films come in (remember the formula for the capacity of two plates with a dielectric in between? The thickness or better thinness of the dielectric does play a crucial role, after all).
- Some others may be totally unknown, but no matter: Thin films do play an important role in many branches of Materials Science and Engineering, and a lot of what we learn in this course can be directly transferred to those applications.

Illustrations of Applications in Semiconductor Technology

Let's just look at a few pictures of thin films in semiconductor technology to get a first flavor of what we are up to. Nothing more needs to be said.



The blue line shows the conduction band of a modern Semiconductor Laser. It is what you want for superior perfomance.
It follows from the sequence of **>25** thin films deposited on top of each other, starting from the **1,5 µm GaAs**, as shown.



SEM cross section through a **64 Mbit DRAM** (**1996** or so).
The "holes" (idiotically called "trenches") contain the capacitor.

TEM picture of a cut through a "trench" containing
one capacitor and **6** thin layers .
"**ONO**" = Oxide-Nitride-Oxide layer sequence;
about **3 nm** per layer.