

ECEn 452 – Semiconductor Devices Lab  
Week 10: “Source and Drain Contacts”  
Background Reading

The following is taken from *Coating Materials News*, a publication of CERAC, inc. (a specialty chemical manufacturer that also deals in evaporation materials)  
Volume 7 - Issue 3      July - September, 1997  
[http://www.cerac.com/pubs/cmn/cmn7\\_3.htm](http://www.cerac.com/pubs/cmn/cmn7_3.htm)

### **Metal Deposition**

Metal films are used in electronic as well as optical applications. In the former, metals form ohmic contacts and interconnects on semiconductor devices. In optics, metals are used to make highly reflecting surfaces. Divergent processing and operating conditions require different deposition procedures. For semiconductors, the requirements are good adhesion along with the ability to pattern, and diffusion stability at high process temperatures. Optical applications require high reflection and low scatter as well as good adhesion and resistance to environmental degradation.

### **Aluminum**

Aluminum adheres well to oxide surfaces such as glass or thin film oxide compounds. It has properties very compatible with silicon electronic circuits and forms ohmic contact. Sheet resistances near 0.1 ohm/sq. are produced for thicknesses between 3000 and 4000Å. Process temperatures must be kept below the Al-Si eutectic temperature of 577° C and low enough to prevent diffusion. Aluminum can be evaporated at a temperature near 1100° C, so resistance heated tungsten boats, coated tungsten wires and e-beam from graphite or BN crucibles can be used. The pressure must be in the 10<sup>-6</sup> Torr range and the rate high (>20 Å/s) to reduce oxidation in the deposited film. The substrate temperature should be below 150° C to obtain small grain size and smooth film surfaces. Aluminum can also be sputter deposited at rates exceeding 1000Å / min.

[Look over an animated version of the MOSFET construction process at the following website:](http://jas.eng.buffalo.edu/education/fab/NMOS/nmos.html)

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