Mapping for MEMS Manufacturing

MEMS Manufacturing Non-Contact Sheet Resistance and Film Thickness Mapping

200 mm and 300 mm Wafers

Although there are many approaches MEMS manufacture, the use of Lehighton Electronics metrology equipment to monitor manufacturing operations can be based on our current capability to measure sheet resistance whenever the layer sheet resistance (Rs) is at least 10 times less than Rs for the underlying material or layers.

In MEMS manufacturing, lithographic and etch procedures are somewhat similar to those used in semiconductor IC manufacturing. In the case of MEMS, much deeper etch procedures are required to define the miniature mechanical structures of MEMS components. Etch stops are needed to control the depth of the deep etch removal process.

As an example of a typical MEMS process, consider the following sequence:

1. Starting material: Silicon with a resistivity (Rho) of 10 ohm-cm

2. Thin the starting material to a thickness, (t) where t = 10 mils

3. Dope the surface of the material with a heavy P+ diffusion to > 5E19 atoms/cm3 to s depth of several microns. The resulting sheet resistance of the surface layer is about 2 ohms per square. This layer acts as a subsequent etch stop for KOH or EDP etching.

In order to meet the 10-to-one requirement needed in order to measure sheet resistance of the heavily diffused layer with the Lehighton Electronics non-contact systems, the sheet resistance of the substrate material must be in this case:

Rs = 10X2 = 20 ohms per square, minimum sheet resistance for the substrate

Since

Rs = Rho/t

We have for the substrate material

Rs = 10/t where we need t in centimeters.

1 mil = 1E-3 inch