Micromachining techniques are seen as an important step forward in the development of microwave circuit and systems. The techniques are able to produce new and enhanced devices such as phase shifters, filters and switches. Such devices will enhance and expand our communications capabilities as the technology matures. Several structures are being considered in the Emerging Device Technology (EDT) Research group at the University of Birmingham, a membrane-structure device is one of them.

Figure 1 shows a membrane structure. It consists of a silicon substrate (grey) which supports a thin membrane (green); it is usually made of Silicon Nitride. The membrane is usually only a few hundred nanometres thick. On the surface of the membrane, metal (red) is deposited to form the circuit layer; the microwave device is made by patterning the metal into a shape which makes up the microwave circuit. Under part of the metallisation the silicon is cut away enabling the metal and membrane to be free standing. This is important as the device performance is improved substantially by having no silicon close by. The dielectric loss and parasitic dielectric modes are eliminated from the design. High quality-factor resonators can be achieved at frequencies of tens of gigahertz. These resonators can be made into filters with low loss performance. A further metalised silicon wafer is bonded to the first to support the structure.

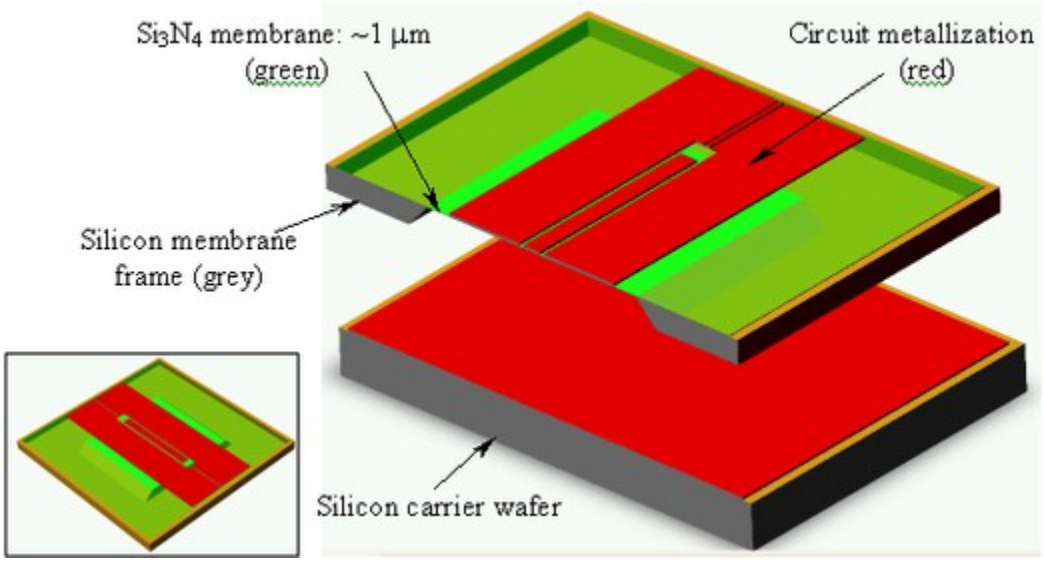

Figure 1. A coplanar line resonator with a membrane structure.

Collaborating with Microsystems and Nanotechnology Research group and external specialist material provider, the Emerging Device Technology group is working on membrane filters and membrane tuneable devices and example of an application is local-multipoint-distribution-systems (LMDS). Both microstrip and coplanar types of bandpass filters operating at ~30 GHz are designed with membrane structures. Figure 2 shows a microstrip membrane filter packaged in a brass box.

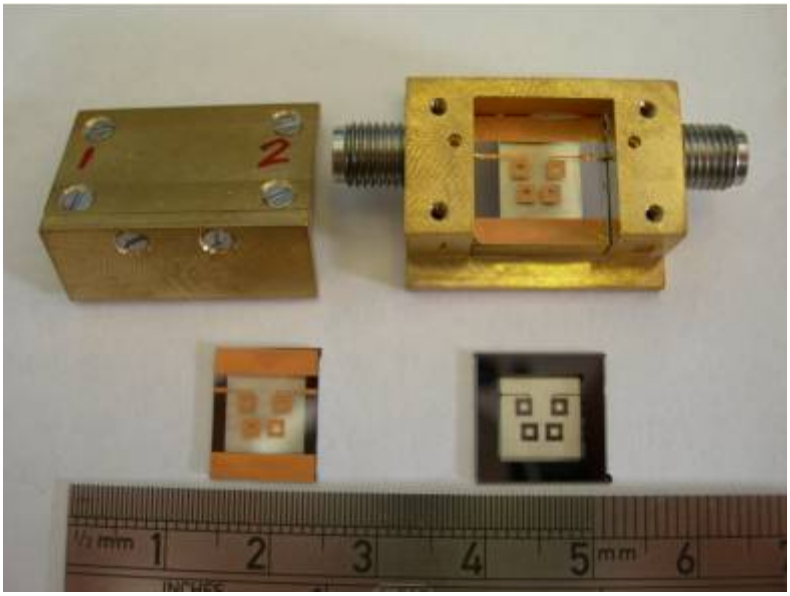

Figure 2. A microstrip membrane filter package in a brass box