MEMS Cs vapour cell with 10mm optical path length

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MEMS alkali vapour cells have applications in a number of emerging Quantum Technology based products including miniaturized atomic clocks, atomic magnetometers and frequency references for laser systems.

In these applications it is normally advantageous to maximize the optical path length (OPL) of the MEMS alkali vapour cell. One approach is to use a glass wafer instead of a silicon wafer interposer [1]. Glass wafers are readily available in a range of thicknesses at lower cost than silicon wafers. They also have lower thermal conductivity and higher heat capacity than silicon resulting in improved thermal stability.

In this we paper we introduce wafer-level processing methods novel to MEMS alkali vapour cell technology, including water-jet etching of glass wafers, glass-glass fusion bonding and thick glass wafer dicing. A MEMS Cs vapour cell is fabricated with an OPL of 10mm. Optical access is via an upper fusion bonded glass window, light is reflected from the back of the cell from a suitably coated anodically bonded silicon substrate.

Preliminary optical absorption and magnetic resonance data are presented.

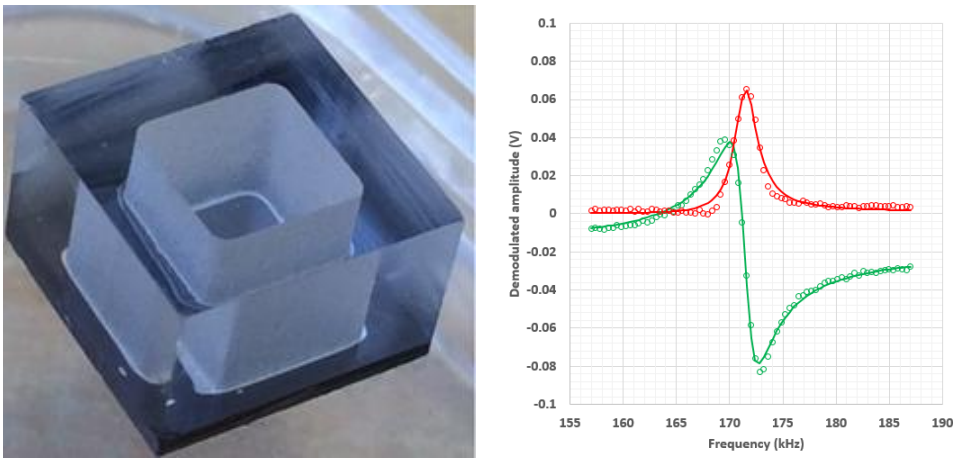

Figure 1: MEMS Cs vapour cell (10mmx10mmx6mm) and magnetic resonance data.

References

[1] Pétremand et al, J. Micromech. Microeng. 22 (2012).