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COMPACT MEMS-BASED SPECTROMETERS FOR INFRA-RED SPECTROSCOPY

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Project objective:

The design, fabrication and testing of deformable, diffractive MEMS gratings to be used as tuning elements in External Cavity Lasers (ECL) and MicroSpectrometers has been accomplished. The resulting devices are compact, fast, efficient and widely tuneable. The fabricated device consists of a free-standing, 1x1mm optical grating with an initial period of 12µm that can be stretched up to 3% by four sets of electrostatic comb drives. High optical efficiency of the diffractive device has also been achieved by blazing the elements using an anisotropic KOH etch. This provides beams with smooth, angled, optical surfaces and increases diffraction efficiency to >90%.

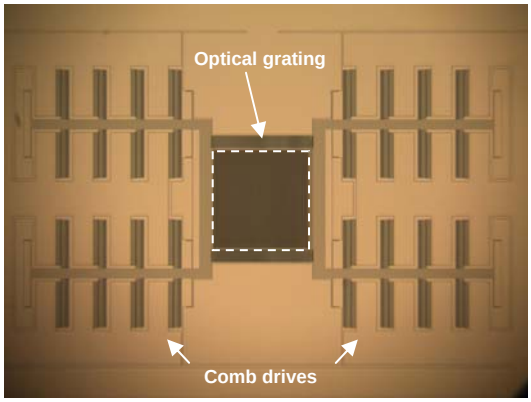

Figure 1: The 1x1mm MEMS grating structure is actuated via four sets of electrostatic comb drives.

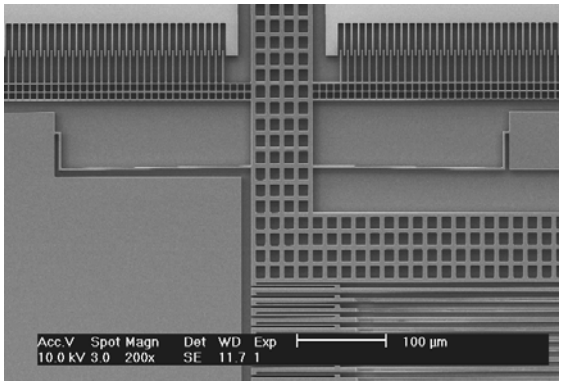

Figure 2: Four compliant beams support the structure while allowing the opposing comb drives to stretch the central grating membrane.

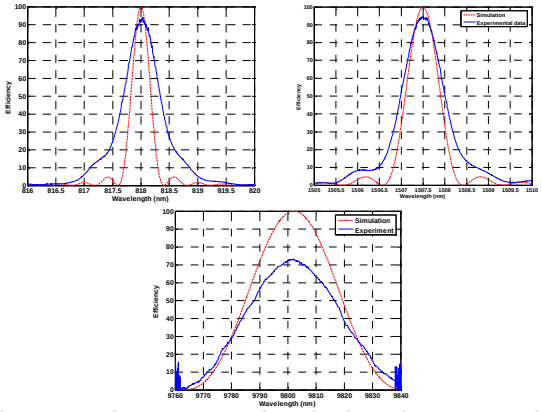

Figure 3: The measured optical performance of the gratings at 800, 1500, and 9800nm.

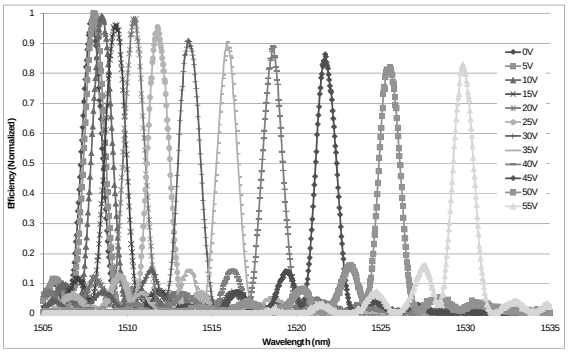

Figure 4: The measured spectral response of a grating as the applied voltage is increased.

Techniques employed:

DRIE, Tilted exposure photolithography, KOH etch, HF vapor release

Publications :

[1] M. Tormen et al, "Deformable MEMS grating for wide tunability and high operating speed," *Journal of Optics A: Pure and Applied Optics*, vol. 8, no. 7, pp. S337-40, 2006.

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