# Grating Light Valves

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## I. Introduction

Grating Light Valve[1] (GLV) display pixels are diffraction gratings, consisting of electrostatically movable microbeams. Non-actuated coplanar beams behave like a mirror giving specular reflection. After actuation, the alternate movable beams are deflected downwards and the grating starts diffracting, which turns the pixel ON. GLV based displays provides a huge improvement in contrast, resolution and switching speed over others. From material perspective, Poly-SiGe has gained serious attention in post processing MEMS above CMOS[2]. It has a lower deposition temperature compared to Poly-Si and possesses the necessary mechanical properties and reliability required for MEMS.

The purpose of this work is to show the functionality of poly-SiGe GLVs. We will demonstrate that high resonant frequency and high contrast can be achieved for these devices.

## II. Fabrication

A CVD deposited structural SiGe layer was grown with a $SiH_4$: $GeH_4$ flow ratio of 0.9:1 and a $B_2H_6$ flow over varying thickness at a chuck temperature of 460°C. Extra layers of 5 nm SiC and 30 nm AlCu were added by sputtering on top of the SiGe to increase the reflectivity of the structure.

## III. Results

The response of the GLVs to a DC voltage is shown in Fig. 1. A clear change in intensity of the 1st order diffracted light with increasing actuation voltage can be observed.

Laser Doppler Vibrometry was used to determine the dynamic response of the GLVs. The underdamped nature of a single actuated microbeam is shown in Fig 2. A resonance frequency of 1.67 MHz was found. It can be seen that the settling time increases to 5us because of insufficient damping.

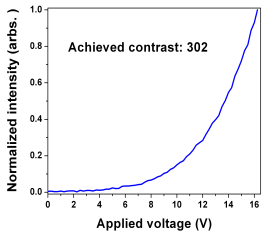


Fig 1. DC response of a GLV device.

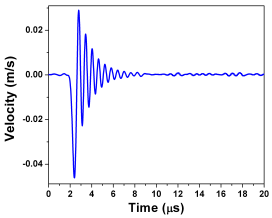


Fig 2. Underdamped behavior of GLVs.

## IV. Conclusions

We demonstrated the operation of a poly-SiGe based GLV with a high contrast of 300:1 and a resonant frequency of 1.67 MHz.

## V. References

[1] Trisnadi *et al*, Photonics West 2004, Micromachining and Microfabrication Symposium, 5348-05

[2] A. Witvrouw, Scripta Materialia, 59 (2008), 945-949.