

# Application of GaAs/GaAsN material system in MEMs tunable filter

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Micromachined tunable filter has been investigated for a long time and been applied in the field of optical communication because of its high quality performance and compatibility with modern WDM communication system[1]. Compared with other tuning mechanisms, electrostatic actuation method for MEMs filter is easier to realize and has better durability.

For free standing structure composing of a tunable cavity, tension force is always necessary not only for the device operation but also for the fabrication process. High-tensile SiN layer can be deposited using PECVD on the free-standing structure to provide the tension force. As we know, there is tension or compression force on the surface between two materials with different lattice constant. It is interesting enough to investigate the as-grown tension force in molecular beam epitaxy (MBE) growth.

The sample was grown in GEN II MBE system with a nitrogen r.f. plasma source. Starting from a silicon doped n-GaAs wafer, 3000Å GaAs buffer layer with Si doping of  $1.0 \times 10^{19}$  was grown followed by a 1000Å buffer layer with doping as low as  $5.0 \times 10^{18}$ , then 20000Å  $\text{Al}_{0.85}\text{Ga}_{0.15}\text{As}$  layer was grown as a sacrificial layer. The free-standing layer was composed of a 6000Å GaAs layer and another layer of 2000Å  $\text{GaAs}_{0.97}\text{N}_{0.03}$  with 200Å GaAs as the cap layer. As shown in figure 1, the SEM pictures clearly show the tension force in the as-grown GaAs/GaAsN material system. It is expected this material system will give better performance of tunability with simplified fabrication process.

## References:

- [1] M. C. Larson, B. Pezeshki, J. S. Harris, Jr. "Vertical Coupled Cavity Microinterferometer on GaAs with Deformable-Membrane Top Mirror", *IEEE Photon. Technol. Lett.* 7 (1995) 382

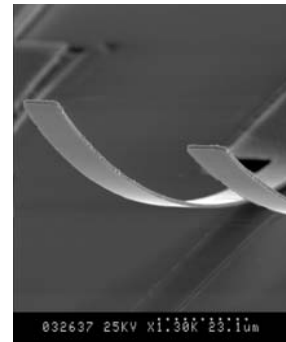
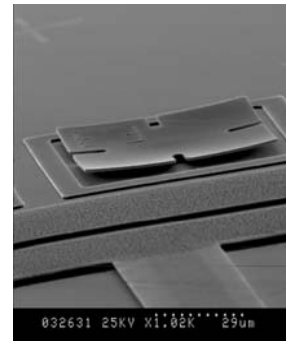
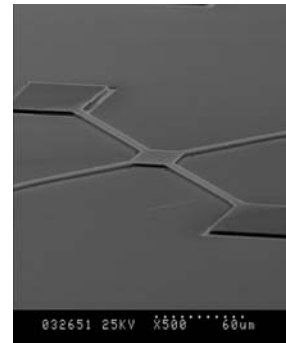


Fig.1 SEM pictures of released structure utilizing GaAs/GaAsN material system, (a) cantilever structure with length of 100um and width of 10um;



(b) disk-like structure with center sitting on the substrate;



(c) filter-like structure with center deformable mirror suspended by four legs.