*Abstract to be submitted to*
*SPIE Micromachining and Microfabrication Conference*

# A Piezoelectric Unimorph Deformable Mirror Fabricated by Wafer Transfer Technology

Eui-Hyeok (EH) Yang

MEMS Technology Group, Jet Propulsion Laboratory
4800 Oak Grove Dr, Pasadena, CA 91109
E-mail: Eui-Hyeok.Yang@jpl.nasa.gov

A precision deformable mirror is a key component of a high-contrast imaging instrument. Micro Electro Mechanical Systems (MEMS) technology has the potential to reduce the mass and volume of the deformable mirrors by several orders-of-magnitude over conventional technologies. The major challenge is obtaining the necessary optical quality, which, if achieved using MEMS technology, will enable the design of smaller, high quality, optical systems. JPL has recently developed a new technology for transferring an entire wafer-level silicon membrane from one substrate to another. A thin membrane, 100 mm in diameter, has been successfully transferred without using adhesives or polymers. A transferred membrane was patterned and its measured peak-to-valley surface error across 1.5 mm by 1.5 mm square shape was only 9 nm. The mirror element actuation principle is based on a piezoelectric unimorph. A voltage applied to the piezoelectric layer induces stress in the longitudinal direction causing the film to deform and pull on the mirror connected to it. The advantage of this approach is that the small longitudinal strains obtainable from a piezoelectric material at modest voltages are thus translated into large vertical displacements. By utilizing the membrane transfer technology, an optical quality mirror membrane can be transferred onto a micro actuator array. The membrane transfer technology will be combined with the piezoelectric unimorph actuator to develop a compact deformable mirror device with a large stroke actuation of a continuous mirror membrane, resulting in compact AO systems.

Words: 285