STEVENS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

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Carnegie Room 315, Time 1:30 pm

MEMS Microshutter Array Devices for James Webb Space Telescope

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We have developed microshutter array systems at NASA Goddard Space Flight Center for use as multi-object aperture arrays for a Near-Infrared Spectrometer (NIRSpec) instrument. The instrument will be carried on the James Webb Space Telescope (JWST), the next generation of space telescope, after the Hubble Space Telescope retires. The microshutter arrays (MSAs) are designed for the selective transmission of light from objected galaxies in space with high efficiency and high contrast. Arrays are close-packed silicon nitride membranes with a pixel size close to 100x200 μm. Individual shutters are patterned with a torsion flexure permitting shutters to open 90 degrees with minimized stress concentration. In order to enhance optical contrast, light shields are made on each shutter for light leak prevention. Shutters are actuated magnetically, latched and addressed electrostatically. The shutter arrays are fabricated using MEMS bulk-micromachining and packaged utilizing a novel single-sided indium flip-chip bonding technology. The MSA flight system consists of a mosaic of 2 x 2 format of four fully addressable 365 x 171 arrays. The system will be placed in the JWST optical path at the focal plane of NIRSpec detectors. MSAs that we fabricated passed a series of qualification tests for flight capabilities. We are in the process of making final flight-qualified MSA systems for the JWST mission.

Dr. Mary J. Li received the M.Sc. and Ph.D degrees in materials science and engineering from the University of Maryland, College Park, in 1989 and 1992, respectively. Dr. Li has extensive experience in semiconductor processing technologies. She is a lead engineer in MEMS device fabrication and reliability testing in microshutter arrays development for space applications. Her expertise on materials characterization of thin-films and interfacial properties provides her capabilities of materials selection and processing procedure verification. She presented multiple invited papers in various MEMS conferences and published more than 60 papers in various technical journals in MEMS device fabrication, microelectronics characterization, materials properties, and two book chapters in microelectronic packaging and reliabilities.

For more information, please contact Prof. EH Yang at Eui-Hyeok.Yang@stevens.edu or 201-216-5574