# A Challenge to Tunable Metamaterial Optical Retarder: Au Nanograting and its Integration with Microelectromechanical Actuators

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Optical metasurface attracts interest as novel micro-optical elements including flat lenses, polarization converters, retarders, waveplates and so on. Metasurfaces are able to have tailored in-plane distribution of optical characteristics. Especially, metasurface optical retarders have opened up advanced optical elements applications such as Laguerre-Gaussian beam converters, optical vortex converters, and computer-generated holography. However, plasmonic metasurfaces have a tradeoff problem between transmittance and retardation because of the lossy nature of metal.

In this study, an optical retarder based on Au nanograting is studied and applied to a half-waveplate and radial polarization converter working in a visilble wavelength[1]. A high-aspect ratio grating structure, i.e. Au nanofin array achieve both high transmittance and large birefringence[2,3]. Furthermore, the grating is integrated with microelectromechanical actuators to achieve reconfigurable characteristics. Both a thermal bimorph actuator[4] and an electrostatic actuator are studied, and the electrostatic type have shown the maximum retardation modulation of 32.4° at the wavelength of 624 nm with an applied voltage of 700 V. This microfabricated structure will open up novel applications for example a small-pixel spatial light modulator (SLM) and future wide viewing-angle electronic holography.

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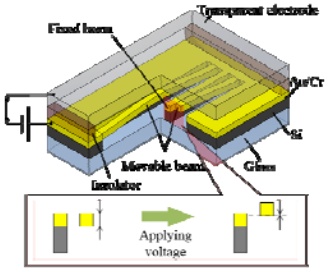


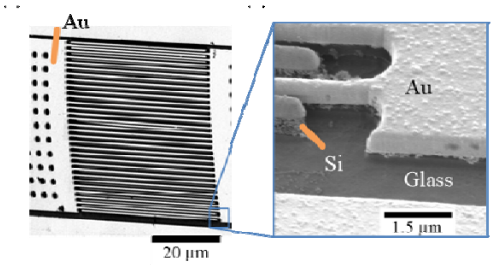


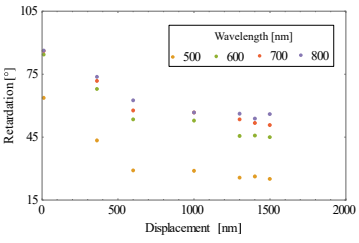


Fig. 1 Nanograting optical retarder. Fig. 2 SEM images of the fabricated device. Fig. 3 Retardation moludation

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