Active Metasurface for Multi-functional Beam Control

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Abstract

Metasurfaces are ultra-thin artificial films built up using periodically arrayed sub-wavelength structures, which interact with electromagnetic wave performing extraordinary properties. Metasurfaces, as a new platform for flat optics, enable plenty of applications such as beam steering, flat lens, cloaking, polarization converter and waveplates and so forth. However, metasurfaces' power of tailoring the properties of electromagnetic waves is suppressed by the fixed structure of metasurfaces. Metasurfaces with tunable functions or multi-functions are desirable for practical applications. Here, we present an active metasurface with high tuning power for multi-functions including dispersion-controlled focusing and beam tracking. In the metasurface, each miniaturized scatter is formed by injecting liquid metal into optofluidic ring-shaped channels. The geometry of the liquid metal is controlled using a pneumatic control system. This tunable metasurface achieved through microfluidic technology releases the great potential of metasurfaces for multi-functional devices, which paves the way for promising practical applications such as achromatic flat lens, beam scanning and beam tracking.

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