The Integration of High-efficiency Vortex Light Emitters by 3D Photolithography

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***Abstract*:** Due to miniaturization, compatibility and high emission efficiency, on-chip vortex light emitters are required in wide-ranging applications, including quantum information, micromanipulation and free-space communication, especially for photonic integrated devices and circuits. X. Cai, et al. demonstrated integrated optical vortex emitters [1], using whispering gallery mode (WGM) silicon microrings with angular gratings to generate free-space beams with orbital angular momentum (OAM). Limited by the dimension of fabrication, the gratings are parallel to the z-axis and thus the z-component of the propagation constant cannot be the maximum. Thanks to the novel 3D photolithography technology (supported by *Nanoscribe*), it is possible to write tilted gratings inside the microrings and the simulation (*Lumerical* FDTD Solution) results showed the emission efficiency of 30-degree tilted could be two times larger than that with the conventional vertical grating. Using IP-Dip (a polymer with two-photon polymerization effect), we designed and fabricated the micro-goblets and waveguide bridges on glass, shown in Fig. 1, and the surface smoothness was improved by gentle oxygen plasma. In addition, our fabrication technology is compatible with the previous work photonic wire bonding – a connector with ultra-low intrinsic loss between fibers and waveguides, and thus it is convenient to integrate the novel vortex light emitters and fibers on a single chip.

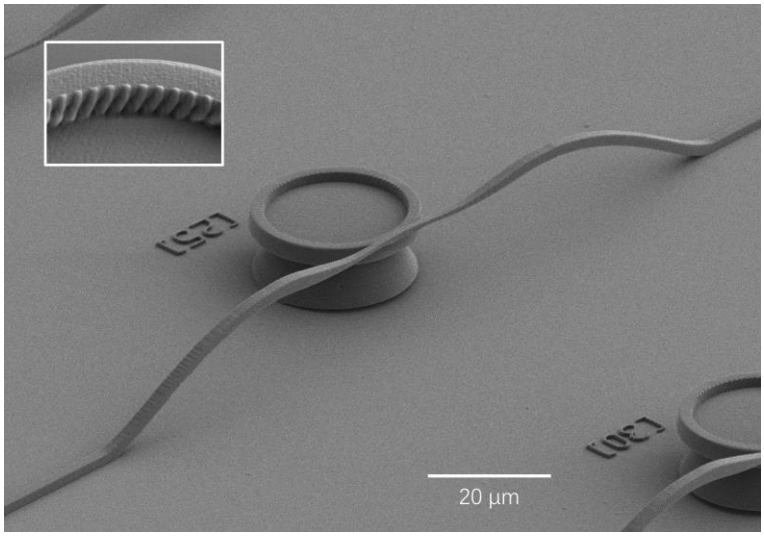

Fig. 1

Reference

[1] Cai X., et al. Science, 2012, 338(6105):363.