Near-field characterization of 2D disk resonator on Bloch surface wave platform

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We experimentally and theoretically investigate the characteristics of a two-dimensional (2D) disk resonator, which is fabricated on a Bloch surface wave platform. Such a platform is exploited to manipulate the surface waves by patterning nano-thin 2D optical components on the top.

The BSWs show potential of long propagation length (e.g., reported, but not limited, up to 2 mm [1], "High refractive index material cover layer for tuning Bloch surface wave properties") and large field enhancement, thanks to low-loss characteristics of dielectric materials. These features make BSWs a good candidate for 2D integrated optics [2]. We excite the BSW using a Kretschmann configuration shown in Fig.1. (a). The near-field intensity distribution over the disk resonator is shown in Fig. 1(b), measured by multi-heterodyne scanning near-field optical microscopy (MH-SNOM), whose details are reported elsewhere [2].

To the best of our knowledge, this is the 1st experimental attempt to investigate the 2D disk resonator on a BSW platform. The measured Q factors is approximately $7x10^3$ for a disk radius of 100 µm, which is comparable to the result of the finite-difference time-domain (FDTD) simulations (Q factor = $2x10^4$) taking into account the fabrication imperfections and leakage losses. On the top right of Fig.1 (b), the BSW propagating along the *y*-direction (on the side of Port 2) is not leakage but the influence of the width of the incident beam. This measured Q factor of the BSW based resonator is approximately 40 times higher than that of the plasmonic based resonators [3]. Such a high-Q-factor disk resonator can serve for many applications, such as wavelength division multiplexing, on-off optical switching, and sensing. These are preliminary results, further near-field investigations and far-field resonance characterizations are on-going, and the upcoming results will be presented in the conference.

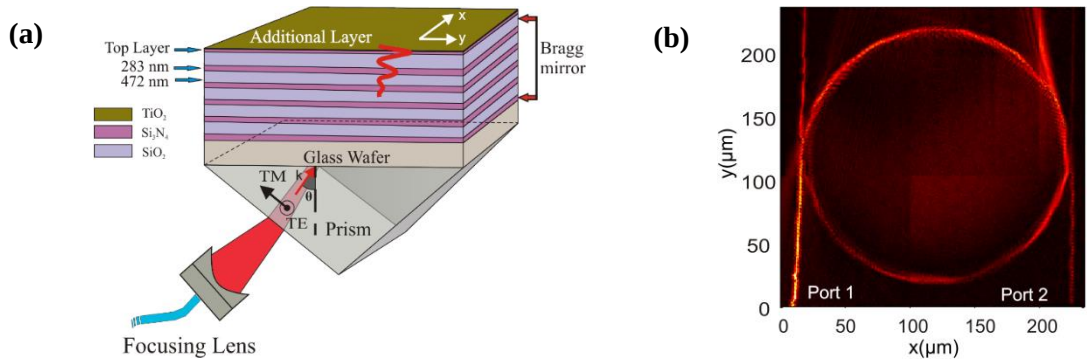

Fig. 1: (a) Schematic of the Kretschmann configuration using a BK7-glass prism to excite the BSW. (b) Nearfield intensity distribution measured by MH-SNOM, when the resonator (radius = 100 - µm) was on resonance at λ = 1.5 µm.

[1] R. Dubey, E. Barakat, M. Häyrinen, M. Roussey, S. Honkanen, M. Kuittinen, and H. P. Herzig, Under review, *Phys. Rev. B.*

[2] T. Sfez, E. Descrovi, L.Yu, M. Quaglio, L. Dominici, W. Nakagawa, F. Michelotti, F.Giorgis, and H.P. Herzig, *Applied Physics Letters* , vol. 96, pp. 151101 (2010).

[3] A. Hosseini,Y. Massoud, *Applied Physics Letters* , vol. 90, pp. 181102 (2007).