Terahertz Slotted Ring Resonator Sensor

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Terahertz frequency range (300 GHz – 3 THz), has a wide range of applications, especially in material sensing and spectroscopy [1]. High resistivity silicon (HR-Si) is a low loss and very low dispersive material at this frequency range, which has been used as an efficient platform for THz dielectric based devices.

Ring resonator, which can have very high quality factor, has been used in numerous devices, especially in the optical range of frequency. Highly sensitive sensors has been proposed based on ring resonator so far. Slotted ring resonator, which has a gap region in the middle of the ring, has been shown to enhance the sensitivity of the sensor in compare to ordinary ring resonator.

In this paper, slotted ring resonator is proposed and designed using HR-Si for refractive index sensing at the THz frequency range. The resonator is located beside a slotted dielectric waveguide, as shown in Fig. 1(b). In Fig. 1(a), the performance of the proposed resonator is compared to ring resonator using simulations at THz frequency range. It is shown that the field confinement in the slot region of the slotted ring resonator enhances the interaction between THz fields and the surrounding sample medium; therefore, sensitivity of the resonator to the change of the refractive index of the sample is enhanced in compare to the ring resonator.

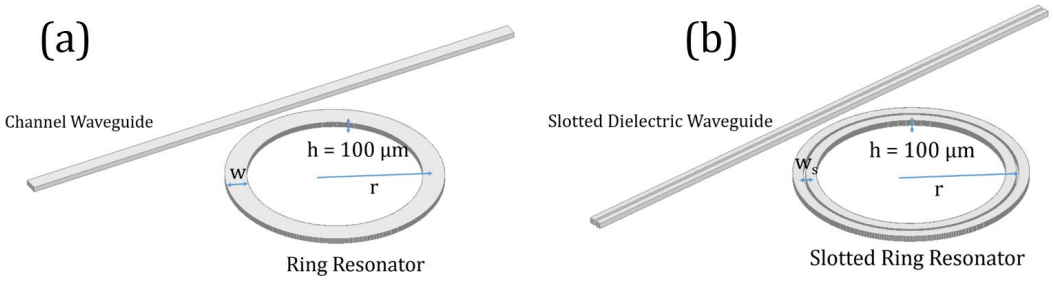

Fig. 1 Ring resonator (a), and slotted ring resonator (b)

[1] Y.-S. Lee, Principles of terahertz science and technology. Springer Science & Business Media, 2009, vol. 170.