THz Spatial Filter with Bimaterial Switching

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Terahertz (THz) technology has rapidly become attractive in recent years due to its potential for applications in communications, imaging, and especially in sensing. Although there are several THz components available commercially, the lack of suitable components in this frequency range is still a challenge in developing THz systems.

Switching of THz filters is essential as it allows the THz sensor to cover desirable frequency ranges. In recent years, several switching methods in THz regime have been observed. Among them, a bimaterial actuator has gained some attention as they do not require complex biasing networks. This type of actuator consists of two materials that have different thermal expansion rate. As temperature changes, the materials go through thermal expansion causing the actuator or anchor to move up and down. As the actuator bends, the capacitance of the junction changes, leading to the resonance control. When the actuator moves up and down as temperature changes, the coupling between the actuators and spatial filter also changes. Thus, the transmission peak is shifted. Some previous works have already proposed bimaterial actuators to reconfigure THz filters. However, lack of good performance and frequency control remain an issue. Here, we consider bimaterial actuators in our THz spatial design. The goal with the proposed design is to develop high performance reconfigurable filters operating in the THz band using temperature tuning.

The proposed THz spatial filter design shows >80% of transmission while the peak varies from 0.35 to 0.37 THz as the biomaterial actuator moves up and down. This result provides higher performance in switchable THz filters compared to the published literatures to date. The fabrication processes and measurement results of the THz spatial filters using biomaterial actuator will be presented at the conference. The equivalent circuit with the bimaterial actuator represented as a variable capacitor will also be discussed.