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Development of tantalum pentoxide (Ta_2O_5) microresonators

Tantalum pentoxide (Ta_2O_5) is an attractive material for integrated photonics due to its high refractive index and wide transparency window. In our study, we designed and tested Ta_2O_5 microresonators using three different coupling methods: edge coupling (where the light is coupled to the side of the chip), grating coupling (where the light is coupled perpendicularly to the chip with a grating), and total internal reflection (TIR) coupling (where the light is coupled perpendicularly to the chip trough printed polymer lens). The devices were first numerically simulated using COMSOL Multiphysics software to ensure the anomalous dispersion regime for nonlinear applications. Our experiments showed that TIR coupling resulted in lower insertion losses and a simpler integration process compared to the other approaches. The resonance spectra and quality factors we measured show a promising potential of Ta_2O_5 platform for applications in sensing and nonlinear optics.

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