Supercontinuum generation in tantalum pentoxide based optical waveguide

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Tantalum pentoxide (Ta_2O_5) is a large bandgap material, which shows ultralow linear and nolinear absorption loss in visible to infrared region. Such optical property enables it to realize low loss optical waveguide platform [1]. Recently, Ta_2O_5 has been widely utilized to demonstrate nonlinear waveguide applications due to its huge optical nonlinearity. For instance, the four-wave-mixing, third-harmonic generation and self-phase modulation have been realized in Ta_2O_5 waveguide structures [2-4]. However, seldom work reports the supercontinuum generation in Ta_2O_5, especially in the visible region.

In this work, the supercontinuum generation has been demonstrated in a 5-mm-long Ta_2O_5 channel waveguide. The Ta_2O_5 film is deposited by using RF sputtering technique. After deposition, the e-beam lithography and reactive ion etching are utilized to fabricate the waveguide structure. By injecting a 100-fs pulse laser at central wavelength of 1-um, the output spectrum of Ta_2O_5 waveguide shows an octave spanning (at -30dB). In addition, the strong visible light at 644 nm is observed in the supercontinuum spectrum, which is attributed to the dispersive wave generation. The position of such dispersive wave can be tunable by changing the waveguide dimension. By increasing the waveguide width from 1500 nm to 2000 nm, the strong visible peak is blue-shifted from 644 nm to 536 nm. Our primary result shows that Ta_2O_5 has great potential in developing visible to infrared broadband light source, which can be applied in optical coherence tomography and frequency metrology.

Reference

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