

TiO₂ for Nonlinear Optical Devices

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Abstract As the demand for computational and telecommunication bandwidth continues to increase solutions are required to overcome the inherent speed limitations of electronic devices. In particular, there is a need for all-optical devices, with their potential for superior bandwidth and transmission rate, to replace various electronic functions. We have identified TiO₂ as a promising yet unexplored material platform for ultrafast, on-chip nonlinear optical devices. TiO₂'s large nonlinear index of refraction is 30 times that of standard silica optical fiber. This nonlinearity can enable such operations as all-optical switching, logic, and wavelength conversion. The material's transparency throughout the visible spectrum makes it compatible with all telecommunications windows. In addition, its high linear index of refraction can enhance optical confinement down to nano-scale dimensions and facilitate the tight waveguide bends necessary for dense on-chip integration. We demonstrate several steps in this process including the evaluation of the material's nonlinearity, deposition and structuring results as well as visible light propagation. By exploring this material, we seek to demonstrate its viability as a novel on-chip nonlinear optics platform.

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