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Vanadium dioxide for terahertz devices[1] NICHOLAS CHARIPAR, HEUNGSOO KIM, SCOTT MATHEWS, ALBERTO PIQUE, Naval Research Lab — We investigate VO_2 as a material for ultrafast sub-millimeter wave devices. This material exhibits a semiconductor to metal transition (SMT) at ∼68 °C which results in a dramatic increase in carrier density ($\sim 10^{19} - 10^{23}$ cm^{-3}). The SMT transition can be induced thermally, electrically, or optically enabling strong interactions and unique device operation. This transition has been exploited for numerous microwave/terahertz devices such as tunable filters and modulators. However due to its low carrier mobility (~ 0.1 cm^2/V-s) and long recovery times ($\sim$ ns), VO_2 has been largely ignored as a possible material for millimeter wave and terahertz pulse generation even though the SMT can occur within 100 fs. VO_2 thin film devices were fabricated and characterized. These devices were capable of generating ∼1 ps electrical pulses. We will present details on the ultrafast switching behaviors of VO_2 along with the design and fabrication of terahertz emitter based on the SMT of VO_2.

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