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Modeling ultra-broadband terahertz waveguide emitters through difference frequency generation using coupled mode theory FELIPE A. VALLEJO , L. MICHAEL HAYDEN, Department of Physics University of Maryland, Baltimore County — We use a coupled mode theory that adequately incorporates both terahertz (THz) and infrared (IR) losses, to model and design ultra-broadband terahertz waveguide emitters (0.1-15 THz) based on difference frequency generation of femtosecond IR optical pulses. We apply the theory to generic, symmetric, five-layer, metal/cladding/core waveguides using transfer matrix theory. Our expressions for the conversion efficiency and output THz power spectrum depend on the pump power, pulse width, beam waists, laser repetition rate, material optical properties, and waveguide dimensions. Using this approach we design waveguides whose active cores are composed of a poled guest-host electro-optic polymer composite DAPC, comprised of DCDHF-6-V chromophores embedded in an amorphous polycarbonate matrix host. The resulting bandwidths are greater than 15 THz and we obtain high nonlinear conversion efficiencies up to $1.2 \times 10^{-4} W^{-1}$. Our results reveal that a perfectly phase-matched structure is not necessarily the one with the highest conversion efficiency. The highest efficiency is obtained by balancing both the modal phase-matching and modal effective loss effects.

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