THz generation control in Ta/Fe/Ru/Ni spintronic emitters

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Abstract. Optical laser pulses impinging at ferromagnet/metal thin film stacks can generate picosecond electromagnetic transients with a frequency content extending into the THz range [1-3]. We fabricated Si/SiO_2//Ta/Fe/Ru/Ni/Al_2O_3 THz emitters in which we varied the magnetization alignment of Fe and Ni layers by interlayer exchange coupling (IEC) using different Ru layer thicknesses (t_{Ru}). Depending on IEC, magnetizations of Fe and Ni show either parallel or anti-parallel relative alignment at t_{Ru} = 1.1 nm and t_{Ru} = 1.3 nm, respectively. As a result, THz emission shows a dramatic variation of amplitude with sub-nanometer changes of t_{Ru} in weak external magnetic fields due to an interference of THz transiens generated at the individual Fe/Ru and Ru/Ni emitters. We explore the effect of the ambient temperature and Ru thickness variations on the THz amplitude.

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