

Amplified Stimulated Terahertz Emission at Room temperature from Optically Pumped Graphene

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Room temperature Terahertz stimulated emission and population inversion in optically pumped graphene is reported. We experimentally observe fast relaxation and relatively slow recombination dynamics of photogenerated electrons/holes in an exfoliated graphene on SiO₂/Si substrate under pumping with a 1550-nm, 80-fs pulsed fiber laser beam and probing with the corresponding terahertz beam generated by optical rectification in a nonlinear electro optical sensor. The time resolved electric field intensity originating from the coherent terahertz photon emission is electro-optically sampled in an total-reflection geometry. The comparison of terahertz electric fields intensities measured on SiO₂/Si substrate and that one from graphene clearly indicate that graphene sheet act like an amplifying medium. The Emission spectra agrees relatively well the pumping photon spectrum and its dependency on the pumping power shows a threshold like behavior, testifying the occurrence of the negative conductivity in the THz spectral range and the population inversion. The threshold pumping intensity $> 5 \cdot 10^6$ W/cm² is in a good agreement with simulations.

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