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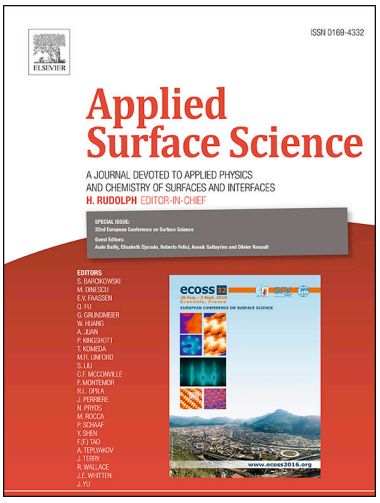

Full Length Article

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Terahertz surface emission from layered semiconductor WSe_2

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ABSTRACT

Ultrafast laser interaction with the layered semiconductors has attracted wide interest due to not only the fundamental physical understanding of the light-matter interaction in these advanced materials, but also the potential optoelectronic devices from visible region to THz region based on these emergent semiconductors. Herein, we investigated the THz radiation property from the layered WSe_2 due to the d-d photo-transition by an ultrafast laser excitation. We observed strong broadband p-polarized THz radiation under different pump polarization and an evident THz radiation saturation with the pump fluence. The THz radiation demonstrated a cosine function with the polarization angle of the pump beam. Angular dependent THz radiation had a polarity reverse with the opposite incident angle and could be fitted well with a dipole approximation model. These results reveal that the dominant mechanism of THz emission is due to the photocarrier surging under the surface field. The azimuthal angle dependence of THz radiation suggested that the dominant contribution is due to the surface depletion field rather than surface field induced optical rectification. In addition, we inferred that the laser damage threshold for the WSe_2 crystal is 3.11 mJ/cm^2 confirmed by both THz emission spectroscopy and Raman Spectroscopy. Our results could provide the fundamental light-matter interaction data for the layered WSe_2 and promise the potential applications of this