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Femtosecond pump-probe second-harmonic generation from silicon nanogratings. YONG AN, AVERY GREEN, ALAIN DIEBOLD, SUNY Polytechnic Institute — Silicon nanogratings with fin-like nanogroove arrays have been used in nanoelectronics to build field effect transistors (FinFETs), which have attracted enormous attention due to their superior electronic properties. They can also be used in photonic systems to achieve desired linear and nonlinear optical functionalities. Here we perform second-harmonic generation (SHG) measurements using femtosecond laser pulses on a set of 28, 42, and 65 nm-pitch Si nanogratings to study rotational anisotropy and ultrafast dynamics of SHG. We observe that in pump-probe SHG experiments, the SHG signal from a Si nanograting can be instantaneously enhanced 32% by an autocorrelated pump pulse. The enhancement is caused by pump-induced transient polarization of photoexcited charge in the nanogratings. We also find that charge photoinjection magnifies the quadrupole SHG component significantly more than the dipole SHG component. These results provide insight into the SHG response at the nanoscale, dynamic behaviors of SHG upon photoexcitation, and ultrafast dynamics of photoexcited carriers in Si nanogratings. Furthermore, SHG results from nanogratings of different pitches provide guidance for using the SHG technique to characterize feature dimensions in Si nanogratings.

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