Abstract Submitted
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Origin of second-harmonic generation of Si nanoinclusions in glass[1] E.J. ADLES, D.E. ASPNES, North Carolina State University — We applied our anisotropic bond model (ABM) to clarify the origin of the second-harmonic-generation (SHG) signals observed by Figliozzi et al.[1] for Si nanoinclusions in glass. The ABM describes nonlinear-optic (NLO) responses in terms of radiation from anisotropically and anharmonically bound bond charges, and differs from conventional force formulations by (1) incorporating anisotropy at the bond level and (2) describing observed NLO intensities as a coherent superposition of radiation from these charges accelerated by the driving field. It therefore provides specific information about the origins of NLO signals at the atomic level. Here, SHG signals from the glass and bulk of the Si inclusions are found to be essentially nonexistent, as expected,[2] in the former case as a result of cancellation of radiation fields of bonds oriented in random directions, and in the latter case due to dielectric screening. Our calculations show that SHG is dominated by gradient effects, specifically from the variation in field across the inclusion (spatial-dispersion and crossed-beam effects), consistent with experiment. The large interface field gradient contributes a weak signal from charge motion transverse to the bond direction. [1] P. Figliozzi et al. Phys Rev Lett 94 (2005). [2] V. L. Brudny et al. Phys Rev B 62 (2000).

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E. J. Adles
North Carolina State University

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