

Nonlinear Optics in Crystalline and Amorphous Silicon-on-Insulator

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Abstract: After an introduction on silicon photonics and on third-order nonlinear effects, the nonlinear properties of silicon are discussed. Then progress on nonlinear optics in silicon is reviewed both for telecom and mid IR bands.

OCIS codes: (190.4380) Four wave mixing; (130.4310) Nonlinear integrated optics

1. Outline of the tutorial

In this tutorial the field of third order nonlinear optics in silicon waveguides is reviewed. The outline of the tutorial is as follows:

- Broad introduction to silicon photonics [1].
- Short introduction to the main third-order nonlinear effects: self-phase modulation, four-wave mixing and parametric amplification, supercontinuum generation, two-photon absorption. Elaboration on the role of high-index contrast and photonic nanowires [2].
- Review of the nonlinear optical properties of silicon both at telecom wavelengths and in the mid IR [3].
- Discussion of the state of the art of experimental demonstrations of nonlinear effects in silicon waveguides and cavities [4-6].
- Discussion of the linear and nonlinear optical properties of hydrogenated amorphous silicon, in comparison to crystalline silicon [7-9].
- Discussion of heterogeneous approaches for nonlinear optics in silicon (ie based on silicon waveguides surrounded by other nonlinear materials) [10-11].
- Outlook for future work.

2. References

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