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Material Candidates for Nonlinear Photonic Devices (I)

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Rapid development of nanofabrication has stimulated the growth of the field of nonlinear photonics. Nonlinear photonic devices are finding their applications in more and more areas, including (but not limited to) classical and quantum communications. The material platforms used for nonlinear photonics on-a-chip range from transparent dielectrics with a relatively weak nonlinearity to semiconductor materials with strong nonlinear interactions. Among the materials for nonlinear photonics, III-V semiconductors stand out due to the large variety of compounds suitable for different spectral ranges that can be realized. There is, however, very little information available on the nonlinear optical performance of various III-V semiconductor compounds. There are very few representatives assessed for their nonlinear optical performance (e.g., AlGaAs), and many more materials offering a variety of operation ranges and applications that have never been studied for that role.

In this presentation, I propose the approach towards identifying interesting material candidates suitable for nonlinear photonics, and present the results of some experimental studies performed in this direction. More specifically, I will talk about our studies of GaN waveguides with wide electronic bandgap, suitable for the applications in the visible and near-infrared spectral ranges. I will also present the results of our experimental realization of passive InGaAsP waveguides that have potentials of being used for wavelength conversion to beyond 2 micrometers, thus expanding the operation range of well-established InGaAsP laser sources to the longer wavelengths.

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