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Synthesis of Amorphous Si3N4-xPx Dielectrics

Alternatives to silicon dioxide and silicon nitride, the traditional dielectric and passivation materials in semiconductor devices, have been the subject of intense research for the past two decades. Alloy compounds whose properties can be tuned via compositional adjustments are of particular interest. These include materials such as silicon oxynitride.

Researchers at Arizona State University have developed a technology that uses compositional tuning to produce a family of amorphous dielectrics with near stoichiometric Si3N4-xPx (x~ 0-1) compositions and adjustable optical response. Precise control of the reactant fluxes produces alloys in which the PSi3 molecular core of the precursor is likely incorporated intact into the covalent nitride network. The incorporation of P systematically decreases the band gap while increasing the refractive index.

Potential Applications

- Silicon based lasers
- Silicon Photonics
- Optical Devices
- Semiconductor Applications
- Silicon based wave guides

Benefits and Advantages

- Incorporation of P into SiNP lowers the band gap
- Increased refractive index
- Greater ability to tune the dielectric properties of these materials than for silicon oxynitrides