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Porous III–V compounds as nonlinear optical materials

Tiginyanu I. M., Kravetsky I. V., Langa S., Marowsky G., Monecke J., Föll H.

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Abstract

Abstract Electrochemical etching is shown to represent a unique approach for tailoring linear and nonlinear optical properties of III–V compounds. We demonstrate that under defined etching conditions uniformly distributed pores with transverse dimensions less than 100 nm are formed. The presence of pores modifies the refractive index of the materials and, with parallel orientation, induces an artificial optical anisotropy, as evidenced by optical transmission studies. Small dimensions of both pore and skeleton entities are shown to provide the optical homogeneity of the porous specimens. The enhanced optical second harmonic generation (SHG) inherent to porous membranes of GaP containing triangular-prism like pores is attributed to giant third order electric field fluctuations. The dependence of the SHG phase matching angle upon the degree of porosity is deduced.