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Towards the design of high performance IR photonics: Optical analysis of textured gallium antimonide surfaces ELLA WASSWEILER, JOHN PRINEAS, FATIMA TOOR, University of Iowa — Gallium antimonide (GaSb) is used for fabrication of various optoelectronics devices, such as laser diodes, light emitting diodes, and photodetectors for the mid-infrared (MIR) wavelengths of 3 μm to 30 μm. Light extraction or collection efficiency of GaSb-based MIR devices can be significantly enhanced by surface texturing due to the density graded effect. However to the best of our knowledge no systematic study exists that analyzes the etch chemistries, surface textures and resultant reflectivity of GaSb surfaces. In this work we present the characterization of GaSb textures and how they correlate to reflectivity in the visible and MIR wavelengths. A parametric sweep of etch chemistries involving hydrofluoric acid (HF), hydrogen peroxide (H_2O_2), and citric acid ($C_4H_6O_6$) provide a variety of surface textures that correspond to low reflectivity in different wavelength regimes. The size of the surface features causes scattering in wavelengths of the same magnitude and as a result lower the reflectivity. In addition an analytical equation derived from our experimental data is presented that correlates reflectivity measurements to etch depth and wavelength, which can used to design high performance IR photonic devices.

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