LINEAR AND NONLINEAR OPTICAL PROPERTIES OF ALUMINIUM NITRIDE FROM THZ TO UV

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Marko Zgonik is a professor of physics at the Faculty of Mathematics and Physics, University of Ljubljana, Slovenia. He is also with Jozef Stefan Institute, Ljubljana, Slovenia. He obtained Ph.D. from University of Ljubljana in 1987, spent several years as a postdoc and team-leader at the Institute for quantum electronics, ETH Zurich, Switzerland, where he collaborated also with postgraduate student Ivan Biaggio, now professor here at Lehigh University. Since 1995 M. Zgonik has a permanent teaching position at the University of Ljubljana. During the last five years he was collaborating with the Wide Bandgap Semiconductor group from North Carolina State University, Raleigh.

M. Zgonik's research interests are nonlinear optical processes for optical frequency conversion in bulk and waveguide structures, interactions of light and matter in single crystal and domain engineered devices both in inorganic and organic materials with the goal of extending the spectral coverage of light sources to UV and THZ range. Presently he is on sabbatical at JILA, Colorado University, Boulder, studying nonlinear optics in atomic vapors.

AlGaN alloys have unique linear and nonlinear optical characteristics that permit the utilization of these materials in optical devices. The two most important properties are a wide transparency window and large non-linear optical coefficients allowing efficient nonlinear conversion into the blue and UV wavelength regions. AlN is a direct semiconductor with a bandgap of 6 eV. Apart from a small absorption region in the mid IR there is no absorption from DC to 200 nm therefore it may be interesting also for THz applications.

Bulk aluminium nitride single crystals are grown by physical vapour transport and contain residual impurities preventing their use in the UV. However good quality AlN layers (waveguides) can be grown by metal–organic chemical-vapor deposition on sapphire substrates. In addition, substrate patterning allows simultaneous growth of domains of different polarities that can be used for quasi phase matched interactions. Our results on bulk and waveguide characterization and second harmonic generation will be reviewed.

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