

“BNC Seminar”

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BRK, ROOM 2001

Igor Melnikov

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Title: Aluminum Oxide as a Self-Organizing Template for Heterogeneous Photonic Crystals

Bio: Igor Melnikov, PhD, is at present a Head of Photonics Lab at the National Research University of Electronic Technology in Zelenograd, Moscow, Russia and the founder and Chief Photonics Officer of High Q Laboratories, Inc., Hamilton, Ontario, Canada. He has 25-years experience in many aspects of photonics and has pioneered a number of developments in chemical lasers, optical memory devices with random access, fiber optics, multiple-wavelength lasers, few-cycle optical pulses, metallo-dielectric layered nano-magnetics, and resonance photonic crystals. The resonance photonic crystal research he has undertaken as a Visiting Professor of the University of Toronto, has been recognized by a whole series of invited and plenary talks at meetings and seminars across the North America and Europe. Together with Igor's work on high repetition rate diode-pumped fiber lasers, this led to a great deal of fundamental research and cutting-edge innovations in the photonics industry. He has been an author/co-author of over 100 papers, participated in prestigious meetings on Quantum Electronics and Photonics around the world, and has given seminars throughout the Western Europe and North America. His contribution in the field of photonics has been recognized by several awards in Canada, China, France, Germany, Mexico, UK, and USA.

Abstract: In this talk, heterogeneous photonic crystals are described that are made of group II-oxides, sulfides, and selenides electrochemically deposited in the template of a self-organizing porous aluminum oxide. The self-organization approach to nano-structured materials and templates looks like a much simpler and, hence cheaper technological alternative to lithography-based ones. The self-organization here might be due an ion bombardment, arc-discharge evaporation, laser ablation, etc. The main disadvantage of this approach is the far-order produced that might as low as a few spatial periods. Easy parameter adjustment pertinent to electrochemical procedures enables us to produce arrays of porous materials with substantially higher level of the far-order. We make use of the method of the aluminum anodizing in order to produce nano-structures in the form of the ordered arrays (templates) of hexagons that have a nanopore in the center. In the next step, the precursor of an All metal is introduced into these pores by means of vacuum or electrochemical deposition technique. Subsequent oxidation, sulfidization, or selenidization synthesizes photonic crystals with controllable morphology and optical properties.