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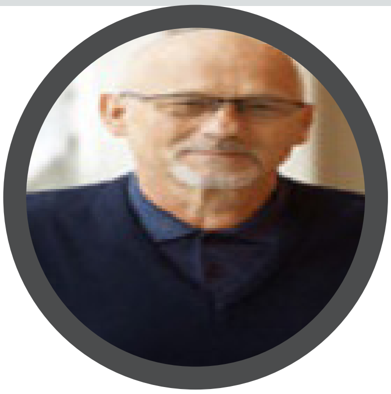
# PHOTO ATOMIC LAYER ETCHING: AN INNOVATIVE TOOL FOR NANOSTRUCTURING OF QUANTUM SEMICONDUCTOR MICROSTRUCTURES



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Etching of semiconducting materials with the atomic level resolution is of a high interest to technologies addressing fabrication of low dimensional devices, tunability of their optoelectronic properties and precise chemical control of device surfaces and interfaces. The so-called digital etching (DE) process that takes advantage of self-limiting reactions was introduced almost 30 years ago for processing of Si devices. This concept has also been explored for etching of GaAs, GaAs/AlGaAs, Ge1xSix compounds, SiO2, SiN and some other materials. Conventional DE consists of a series of two cycles, each involving a limited or self-limited reaction step followed by a step designed to remove reaction products from processed surfaces. Typically, 0.1-1.5 nm of material is etched in each cycle which is calculated based on post-processing measurements. The lack of diagnostics that would allow monitoring this process *in situ* is a significant drawback of conventional DE techniques. We have demonstrated that for photoluminescence (PL) emitting GaAs/AlGaAs nanoheterostructures, it is possible to carry out PL-monitored photocorrosion in cycles analogous to those employed in DE. The advantage of this digital photocorrosion (DIP) process, carried out in liquids that support photocorrosion, but do not react significantly with materials in darkness, is that it could be carried out in cycles with a sub-monolayer resolution and simultaneously monitored with PL. Recently, we have demonstrated that DIP could also be monitored with open circuit potential (OCP) measurements. An excellent agreement between the position of GaAs/AlGaAs interfaces revealed during photocorrosion by PL and OCP suggests that DIP could also be monitored *in situ* for other materials with non-measurable PL. I will discuss fundamental parameters describing this novel diagnostics process, as well as its application for both sensing and nanostructuring of III-V quantum semiconductors. The perspective of congruent decomposition of compound semiconductor nanoheterostructures with *in situ* monitored atomic layer resolution will also be discussed

### Biography

Jan J Dubowski received his PhD degree in Semiconductor Physics from the Wroclaw University of Technology, Poland. He is a Canada Research Chair and a full Professor at the Department of Electrical and Computer Engineering of the University de Sherbrooke, Canada. He is a Fellow of SPIE- The International Society for Optics and Photonics (citation: "For innovative methods of investigation of laser- matter interaction"). He has published over 200 research papers, reviews, book chapters and conference proceedings. He is an Associate Editor of the Journal of Laser Micro/Nanoengineering, Biosensors and Light: Science & Applications.

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