

Nathan P. Bickel

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ACADEMIC HISTORY

[CREOL, The College of Optics & Photonics](#), University of Central Florida, Orlando, FL

◆ **Ph.D. in Optics ■ 2010** **GPA: 3.87/4.0**

Advisor: Dr. Patrick LiKamWa

Dissertation Title: “*Electro-Optical and All-Optical Switching in Multimode Interference Waveguides Incorporating Semiconductor Nanostructures*”

[Institute of Optics](#), University of Rochester, Rochester, NY

◆ **M.S. in Optics ■ 1999** **GPA: 3.45/4.0**

◆ **B.S. in Optics ■ 1998** **GPA: 3.25/4.0**

Academic Honors

◇ 1998 Graduated with Distinction.

◇ Deans List 7/8 Semesters.

Scholarships and Awards

- ◆ SPIE Educational Scholarship in Optical Science and Engineering (2008).
- ◆ SPIE Educational Scholarship in Optical Science and Engineering (2007).
- ◆ SPIE Educational Scholarship in Optical Science and Engineering (2005).
- ◆ National Science Foundation Integrative Graduate Education Research and Training (IGERT) Fellowship in Optical Communications and Networking (2002 – 2006).
- ◆ CREOL Research Fellowship (2002).

RESEARCH SCIENTIST

Innovative, resourceful, and detail-driven individual, with interdisciplinary training in the research and development of semiconductor based photonic devices. Strong team member but proven capable as an independent researcher. Good communications and interpersonal skills, with years of experience in cross-cultural interaction. Push until project is done attitude.

QUALIFICATION SUMMARY

- ◆ Originated processes for the integration of multiple functions into more complex photonic devices.
- ◆ Generated alternative fabrication methods, as needed, to realize design goals.
- ◆ Detailed, hands-on knowledge of micro- and nanofabrication processes for semiconductors, dielectrics, metals, and polymers.

CAREER HIGHLIGHTS

CREOL, The College of Optics & Photonics, University of Central Florida, Orlando, FL

Postdoctoral Research Scientist

8/2010-12/2010 (Short-term Contract)

- ◆ Construction of nonlinear optical isolators as key part of a multi-institution project.
- ◆ Electron beam processing of photolithographic masks and nano-imprinting masters.
- ◆ Oversaw all day-to-day lab and cleanroom operations; mentored graduate students.

Graduate Research Assistant

8/2002-8/2010

- ◆ **Photonic Device Development (III-V Wafer Materials):**
 - ◇ Originated method for suppression of vacancy disordering in quantum dots. Required fewer process steps vs. existing methods which reduced cycle time and cost.
 - ◇ Leveraged challenges posed by equipment losses to establish waveguide fabrication method for semiconductor devices now employed group-wide.
 - ◇ Addressed design issues and realized compact, multimode, all-optical switches.
 - ◇ Modeled photonic integrated circuits using beam propagation analysis software.
 - ◇ Development of MQW-based beam steering devices, with steering controlled through the creation of virtual waveguides. Provided an alternative to component cascading.
 - ◇ Tailored dry etching and PECVD processes to meet device fabrication requirements.
- ◆ **Nanostructure/Nano-Device Fabrication:**
 - ◇ Solved challenges in creating sub-100 nm, high aspect ratio, nanopillar arrays.
 - ◇ Conducted studies on nanopore formation in semiconductors for device application.
- ◆ **Cleanroom Operations:**
 - ◇ All day-to-day supervision – Established standardized training process, wrote user and equipment manuals, initiated push to bring facility in line with EHS regulations, and dealt with suppliers.

ASML, Fine Alignment Group, Wilton, CT

Optical Manufacturing Engineer/Lead Engineer

1/2000-8/2002

◆ **Manufacturing:**

- ◇ Identified manufacturing issues on step and scan lithography systems and generated solutions.
- ◇ Promoted to lead engineer on QML projection optics line after 1 year.
- ◇ Minimized production delays by actively monitoring photolithographic test stands.
- ◇ Field service liaison and primary diagnostician for “in the field” alignment corrections of optical systems (On call all hours).

◆ **Process and System Development:**

- ◇ Introduced procedures to shift responsibility of certain process steps to technicians, freeing engineering staff for more essential work.
- ◇ Diagnosed production issues for 193 nm (Micrascan V) projection optics line, working extended hours to push completion (10 to 15 per week).
- ◇ Physical buildup and alignment of lithography test stand for 157 nm system.

OTHER SKILLS

◆ **Software Tools:**

- ◇ BeamPROP (BPM), LabVIEW, MATLAB, Origin, AutoCAD, L-Edit, Adobe Photoshop, and Microsoft Office Suite.

◆ **Equipment:**

- ◇ Plasma enhanced chemical vapor deposition (PECVD), reactive ion etching (RIE), ICP-RIE, rapid thermal annealing systems, and diffusion furnaces.
- ◇ Scanning electron microscope, atomic force microscope, and micro-profilometers.
- ◇ Thermal evaporation and electron beam evaporation systems.
- ◇ Photolithography, electron beam lithography, and mask aligner technology.
- ◇ Optical spectrum analyzers, photodetectors, optical circulators, and power meters.
- ◇ Lasers systems operation: Fiber lasers, Ti-Saph, Argon-Ion, etc.

REFERENCES

Available Upon Request

JOURNAL PUBLICATIONS

- ◆ N. Bickel and P. LiKamWa, *Enhanced control over selective area intermixing of $In_{0.15}Ga_{0.85}As/GaAs$ quantum dots through post-growth exposure to radio frequency-plasma*, Thin Solid Films, 519 (2011) 1955. doi:10.1016/j.tsf.2010.10.023.
- ◆ D. A. May-Arrijoja, N. Bickel, A. Alejo-Molina, M. Torres-Cisneros, J. J. Sanchez-Mondragon, P. LiKamWa, *Intermixing of InP-based multiple quantum wells for integrated optoelectronic devices*, Microelectronics Journal, 40 (2009) 574.
- ◆ N. Bickel, and P. LiKamWa, *Etched Quantum Dots for All-Optical and Electro-Optical Switches*, Microelectronics Journal, 39 (2008) 362. doi: 10.1016/j.mejo.2007.07.042.
- ◆ D.A. May-Arrijoja, N. Bickel, and P. LiKamWa, *Robust 2x2 multimode interference optical switch*, Optical and Quantum Electronics, 38 (2006) 557.
- ◆ D. A. May-Arrijoja, N. Bickel, and P. LiKamWa, *Optical beam steering using InGaAsP multiple quantum wells*, IEEE Photonic Technology Letters, 17 (2005) 333.
- ◆ K. L. Marshall, J. Haddock, N. Bickel, D. Singel, S. D. Jacobs, *Angular-scattering characteristics of ferroelectric liquid-crystal electro-optical devices operating in the transient-scattering and the extended-scattering modes*, Applied Optics, 38 (1999) 1287.

CONFERENCE PAPERS

- ◆ A. J. Zakariya, N. Bickel, and P. LiKamWa, *Controlled intermixing of multiple quantum wells for broadly tunable integrated lasers*, Novel In-Plane Semiconductor Lasers X, SPIE Photonics West 2011, January, 2011.
- ◆ N. Bickel and P. LiKamWa, *2 x 2 Quantum Dot Based Multimode Interference Switching Device*, NanoFlorida 2008, September, 2008. (Presenter)
- ◆ N. Bickel and P. LiKamWa, *Etched Quantum Dots for All-Optical and Electro-Optical Switches*, Low Dimensional Structures and Devices, April, 2007. (Presenter)
- ◆ N. Bickel, D. A. May-Arrijoja, and P. LiKamWa, *A 1x3 Optical Switch by Carrier Induced Beam-Steering on InP*, SPIE Defense and Security Symposium, April, 2007. doi:10.1117/12.721920. (Presenter)

CONFERENCE PAPERS

- ◆ N. Bickel and P. LiKamWa, *Deep Etching of Multiple Quantum Well Structures for the Fabrication of Quantum Boxes*, NSF 2007 IGERT Principal Investigators Meeting, April, 2007. (Presenter)
- ◆ D. A. May-Arrijoja, N. Bickel, and P. LiKamWa, *Integrated 1x4 Photonic Switch*, OSA 2005 Annual Meeting, October, 2005.
- ◆ D. A. May-Arrijoja, N. Bickel, R. J. Selvas-Aguilar, and P. LiKamWa, *MMI-based 2x2 Photonic Switch*, Optics East 2005, October, 2005. doi:10.1117/12.630955. (Presenter)
- ◆ D.A. May-Arrijoja, N. Bickel, and P. LiKamWa, *Integrated beam-steered optical switch*, SPIE Defense and Security Symposium, April, 2004. doi: 10.1117/12.543855.
- ◆ D.A. May-Arrijoja, N. Bickel, and P. LiKamWa, *Reconfigurable 1x4 optical switch in InGaAsP multiple quantum wells*, Optilas/RIAO 2004, October, 2004.
- ◆ N. Bickel, D.A. May-Arrijoja, and P. LiKamWa, *Optical beam steering in InGaAsP multiple quantum wells*, OSA 2004 Annual Meeting, October, 2004. (Presenter)

NONCONFERENCE PRESENTATIONS

- ◆ Nathan Bickel, *Advancements in Vacancy Disordering for III-V Wafers and in Photonic Switching Devices*, Benet Laboratories, Watervliet Arsenal, Watervliet, NY, April, 2011.
- ◆ Nathan Bickel, *Photonic Switching in Multimode Interference Waveguides Incorporating Semiconductor Nanostructures*, Naval Research Laboratory, Washington, DC, January, 2011.
- ◆ Nathan Bickel, *Monolithic Integration, Photonic Devices and High Aspect Ratio Nanostructures*, Physics Department, University of Central Florida, Orlando, FL, November, 2010.