CONGSHAN WAN

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EDUCATION

Georgia Institute of Technology, Atlanta, GA — Jan 2015 - May 2019
Doctor of Philosophy in Department of Electrical & Computer Engineering (Optics and Photonics) — GPA: 4.00/4.00

Georgia Institute of Technology, Atlanta, GA — Aug 2013 - Dec 2014
Master of Science in Department of Materials Science & Engineering (Chemistry) — GPA: 3.62/4.00

University of Illinois at Urbana-Champaign, Urbana, IL — Aug 2009 - May 2013
Bachelor of Science in Department of Materials Science & Engineering (Semiconductor) — GPA: 3.85/4.00

RESEARCH EXPERIENCE

Graduate Research Assistant, ECE, Georgia Tech Advisors: T. K. Gaylord and M. S. Bakir Jan 2015 - Present

Project 1: Efficiency Optimization and Angular Misalignment Analysis of Interlayer Grating Couplers for 2.5D/3D Integrated Photonics

- Proposed a new simulation method based on the rigorous coupled-wave analysis (RCWA) to accurately calculate the coupling efficiency of interlayer grating couplers with various profiles and analyze the effects of angular misalignments
- Demonstrated proficiency in optimization algorithm, Matlab/Python, FDTD (Lumerical and MEEP), FEM (Comsol), and ray tracing (Zemax) simulations as well as solid understanding of integrated photonics and diffractive optics

Project 2: Design and Fabrication of Grating-Assisted-Cylindrical-Resonant-Cavities (GARC) Interlayer Couplers for 2.5D/3D Integrated Photonics

- Invented a new type of interlayer optical coupler (GARC) based on cylindrical resonant cavities and circular gratings to achieve efficient and broadband interlayer coupling, which is disclosed in U.S. Patent Application No. 62/557,240
- Microfabricating the designed GARC couplers and grating couplers using Si/CMOS techniques, and measuring the coupling efficiency and the spectral response using IR tunable laser, polarizer, lock-in amplifier and photodetector

Project 3: Design and Fabrication of Self-Aligned Fiber Alignment Fixture for Easier Integration

- Fabricating a self-aligned fiber/fiber array alignment fixture using the laser lithography (two photon polymerization)
- Demonstrated strength in microfabrication, optical system integration/alignment, optical metrology, and data analysis

Graduate Research Assistant, MSE, Georgia Tech Advisor: Z. Lin Aug 2013 - Dec 2014
Project: Core-shell Nanoparticle Synthesis Using Atomic Transfer Radical Polymerization (ATRP)

- Constructed COMSOL model (FEM) of Au/TiO_2 nanoparticles and performed surface plasma resonance analysis
- Synthesized block-copolymer chains on star-like micro-initiators as bi-phased and spherical nanoparticle scaffords

Undergraduate Research Assistant, MSE, UIUC Advisor: J. Rogers Aug 2010 - May 2013
Project: Single-Walled Carbon Nanotube (SW-CNT) Synthesis and Transistor Fabrication

- Fabricated FeO catalyst lines by microfabrication techniques and produced CNTs by chemical vapor deposition
- Integrated semiconducting CNTs as channels in transistors and tested I-V characteristics by the probe station

Undergraduate Senior Design, MSE, UIUC Advisor: M. Shim Jan 2013 - May 2013
Project: Flexible/Wearable QLED Display Integration and Testing

- Sandwiched self-assembled CdSe quantum dot monolayer between TFB (with PEDOT:PSS) HTL and ZnO nanoparticle ETL, which was then encapsulated by ITO coated parylene-epoxy and transfered to a flexible polyimide substrate
- Measured the PL of the quantum dot layer and J-V-L, EL and EQE characteristics of the QLED

INTERNSHIP EXPERIENCE

Summer Intern, OFS Fitel LLC Advisor: D. Peckham May 2017 - Aug 2017
Project: Dopant Diffusion Modeling and Fiber Testing

- Developed dopant diffusion models for fiber D_2 treatment and reaction-limited process using Python
- Conducted microbending/macrobending test and OTDR test on single-mode fibers and SCUBA fibers
- Improved fusion splicing recipes for single-mode fibers, submarine SCUBA fibers and terrestrial ULL fibers

Summer Intern, Institute of Microelectronics at Chinese Academy of Science June 2011 - Aug 2011
Project: Fabrication and Testing of Resistive-Switching Nonvolatile Memory RRAM

- Deposited TaO_x thin films by reactive RF magnetron sputtering using a Ta target in oxygen ambient and controlled oxygen profile of TaO_x by annealing in oxygen
- Investigated the oxidation-reduction mechanism of RRAM's conducting channel and measured channel resistances, I-V curves and set/reset currents

PUBLICATIONS

Journal Papers:

- ***C. Wan***, T. K. Gaylord, and M. S. Bakir, "Grating design for interlayer optical interconnection of in-plane waveguides," Appl. Opt. vol. 55, no. 10, pp. 2601-2610, 2016. ***Featured on the journal cover*** (Ph.D. Project 1)
- ***C. Wan***, T. K. Gaylord, and M. S. Bakir, "RCWA-EIS method for interlayer grating coupling," Appl. Opt. vol. 55, no. 22, pp. 5900-5908, 2016. (Ph.D. Project 1)
- ***C. Wan***, T. K. Gaylord, and M. S. Bakir, "Rigorous coupled-wave analysis equivalent-index-slab method for analyzing 3D angular misalignment in interlayer grating couplers," Appl. Opt. vol. 55, no. 35, pp. 10006-10015, 2016. (Ph.D. Project 1)
- ***C. Wan***, T. K. Gaylord, and M. S. Bakir, "Circular waveguide grating-via-grating for interlayer coupling," IEEE Photon. Technol. Lett., vol. 29, no. 21, pp. 1776-1779, 2017. (Ph.D. Project 2)
- ***C. Wan***, T. K. Gaylord, and M. S. Bakir, "Grating-assisted-cylindrical-resonant-cavities interlayer coupler," Appl. Opt. vol. 57, no. 18, pp. 5079-5089, 2018. (Ph.D. Project 2)
- X. Pang, ***C. Wan***, M. Wang, and Z. Lin, "Strictly biphasic soft and hard Janus structures: synthesis, properties, and applications," Angew. Chem. Int. Ed., vol. 53, no. 22, pp. 5524-5538, 2014. (M.S. Project)

Book Chapter:

- M. Zia, ***C. Wan***, Y. Zhang, and M. S. Bakir, "Electrical and photonic off-chip interconnection and system integration," in *Optical Interconnects for Data Centers*, T. Tekin, R. Pitwon, A. Hakansson, and N. Pleros. (Elsevier, 2016), pp. 265-283.

Conference Proceedings:

- ***C. Wan***, T. K. Gaylord, and M. S. Bakir, "Grating design for 3-D interconnections of waveguides in overlaid chips using the RCWA-EIS method," in *Frontiers in Optics* (Optical Society of America, 2016), paper JW4A. 127.
- ***C. Wan***, T. K. Gaylord, and M. S. Bakir, "Waveguide grating couplers in overlaid chips: efficiency optimization and angular misalignment simulation," in *Frontiers in Optics* (Optical Society of America, 2017), paper JW4A. 94.
- ***C. Wan***, T. K. Gaylord, and M. S. Bakir, "Si/SiO_2 interlayer coupler based on cylindrical resonant cavities," in *IEEE Research and Applications of Photonics In Defense Conference* (IEEE, 2018), invited.

Intellectual Property:

- Circular waveguide grating-via-grating for interlayer coupling, U.S. Patent Application No. 62/557,240.

Master Thesis:

- Functional Nanoparticles: Synthesis and Simulation, Georgia Institute of Technology, 2014.

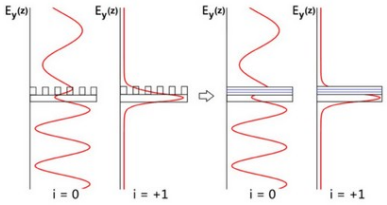
TECHNICAL STRENGTHS

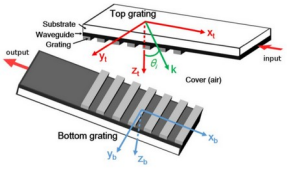
Software and Programming Skills:
Matlab, Python, LabVIEW, COMSOL, Lumerical (FDTD, MODE, DEVICE, INTERCONNECT), MEEP FDTD, SAS JMP, Zemax, ANSYS, Autocad, Solidworks, BEAMER, Latex, InDesign, PhotoShop, Illustrator, C and C++, Java
Electromagnetic/Optoelectronics Theory and Devices:
Fourier optics, diffractive optics, geometric optics, integrated photonics, passive components (waveguide, fiber, grating, coupler, splitter, resonator, interferometer, etc.), active components (laser, photodetector, modulator, amplifier, multiplexer, switch, etc.), gratings for AR glasses, spatial light modulator (MEMS, liquid crystal), imaging theory (Abbe's and Hopkins' method), full-wave simulation (FDTD, FEM), RCWA, BPM, coupled mode theory, coupled wave theory
Optical system integration and testing:
passive alignment (flip-chip bonder), active alignment (6-degree rotation stage, laser, photodetector, etc.), high-speed test equipment (DCA, VNA, BERT), optical measurement (time-of-flight, frequency domain, linewidth, optical power)
Microfabrication and Microscopy Techniques:
Lithography (UV, laser and e-beam), mask alignment, e-beam evaporation, CVD (PECVD, LPCVD), ALD, RIE (ICP), oxygen plasma treatment, sputtering, transfer printing, liftoff, SEM, ATM, TEM, 3D printing, TPP

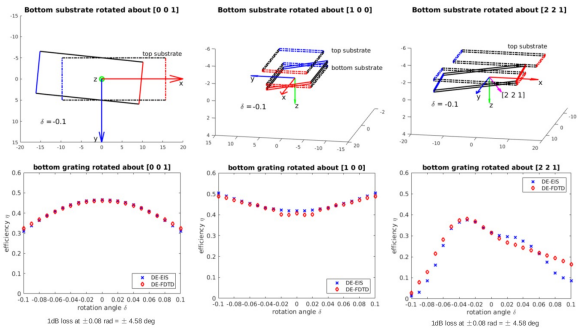
PROJECT OVERVIEW

Please visit https://congshanwan.github.io for movies.

Project 1: Efficiency Optimization and Angular Misalignment Analysis of Interlayer Grating Couplers

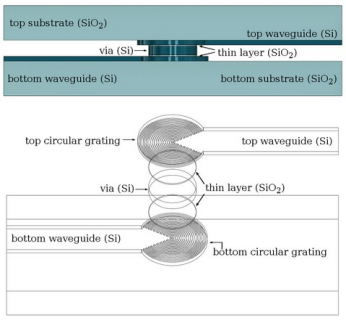


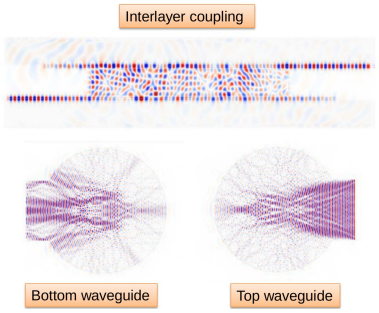


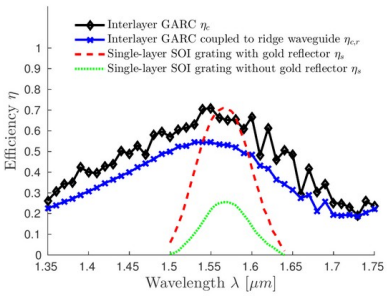


New "equivalent-index-slabs" concept to assist rigorous coupled-wave analysis (RCWA) in analyzing waveguide gratings involving surface waves and angular misalignment. Code implemented in Matlab/Python.

Project 2: Design of Grating-Assisted-Cylindrical-Resonant-Cavities (GARC) Interlayer Couplers

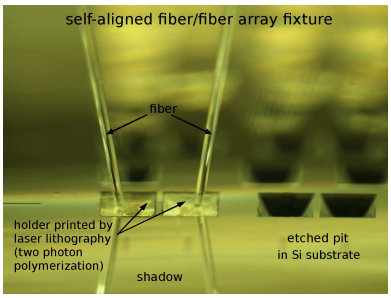


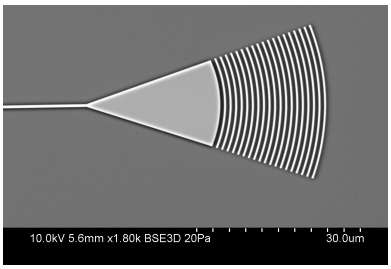


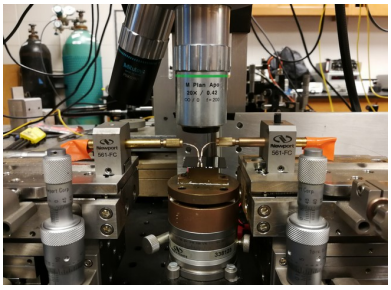


Fundamentally new interlayer coupler to achieve efficient and broadband coupling. Simulated by MEEP 3D FDTD.

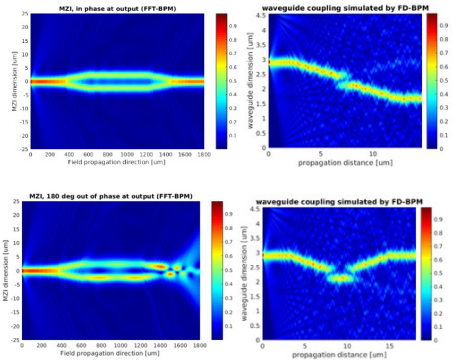
Project 3: Fabrication and Testing of Focusing Fiber Grating Coupler and GARC Coupler

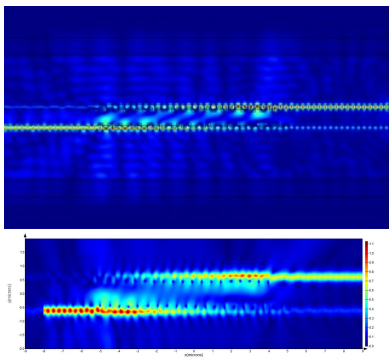






Side Projects: FDTD, FEM, and BPM Simulations





Self-coded FFT-BPM and FD-BPM

COMSOL FEM (top) and Lumerical FDTD solutions (bottom)

Previous Project: CNT FET and QLED