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   GPA: 4.00/4.00

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

University of Illinois at Urbana-Champaign, Urbana, IL   Aug 2009 - May 2013
Bachelor of Science (with honor) in Department of Materials Science & Engineering   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 the rigorous coupled-wave analysis – equivalent index slab (*RCWA-EIS*) method to accurately calculate the coupling efficiency of interlayer grating couplers with various profiles
· Developed a simulation tool based on the proposed *RCWA-EIS* method using Matlab to efficiently optimize the interlayer grating coupling efficiency and provide the first angular misalignment analysis
· Demonstrated a grating optimization tool that is more computationally efficient than commercial software based on the finite-difference time-domain method (*FDTD*) or the finite element method (*FEM*)

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

· Invented fundamentally new *GARC* couplers based on cylindrical resonant cavities and Bessel-function-defined circular gratings to achieve efficient and broadband interlayer coupling
· Simulated and optimized the *GARC* couplers using MEEP FDTD and verified by Lumerical FDTD
· Microfabricating the designed *GARC* coupler and measuring the interlayer coupling efficiency and spectral response

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

· Designing and fabricating a novel multiple-use self-aligned fiber-to-grating alignment fixture
· Aligning fiber arrays to the gratings and measuring the fiber-to-grating coupling efficiencies and repeatability

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 nanoparticle scaffords
· Synthesized bi-phased and spherical NPs with better morphology compared with NPs synthesized by other methods

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
· Increased CNT density by two times and implemented CNTs with semiconducting properties as channels in transistors
· Tested CNT-based transistors by the probe station and analyzed I-V characteristics

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 Matlab
· 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, LabVIEW, COMSOL, Lumerical (FDTD, MODE, DEVICE, INTERCONNECT), MEEP FDTD, Zemax, SAS JMP, Autocad, Solidworks, GenISys BEAMER, Latex, InDesign, PhotoShop, Illustrator, C and C++, Java
Electromagnetic Theory and Devices:
Fourier optics, diffractive optics, photonics, waveguide, fiber, modulator, resonator, interferometer, photonic crystals
Optoelectronics Theory and Devices:
laser, light-emitting diode, solar cell, photodetector
Electromagnetic Simulation Skills:
finite-difference time-domain, finite element method, rigorous coupled-wave analysis, beam propagation method
Microfabrication Techniques:
UV lithography, laser lithography, e-beam lithography, mask alignment, e-beam evaporation, chemical vapor deposition, atomic layer deposition, reactive ion etching, oxygen plasma treatment, sputtering, transfer printing
Microscopy Techniques:
scanning electron microscopy, atomic force microscopy, transmission electron microscopy
**Solution-Based Chemical Synthesis and Analysis**:
distillation, rotary evaporation, precipitation, column chromatography, gel permeation chromatography, atom transfer radical polymerization, nuclear magnetic resonance testing

PROJECT OVERVIEW

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

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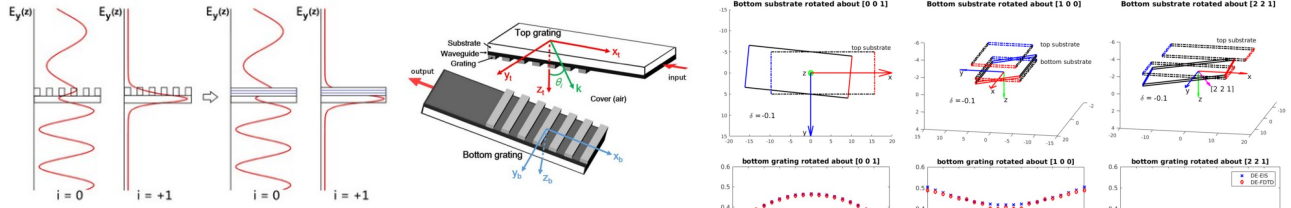

New "equivalent-index-slabs" concept to assist rigorous coupled-wave analysis (RCWA) in analyzing waveguide gratings involving surface waves and angular misalignment. Code implemented in Matlab.

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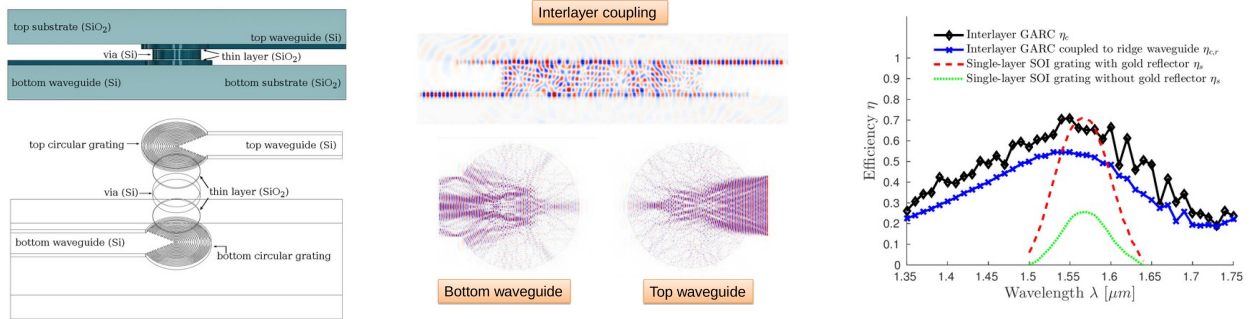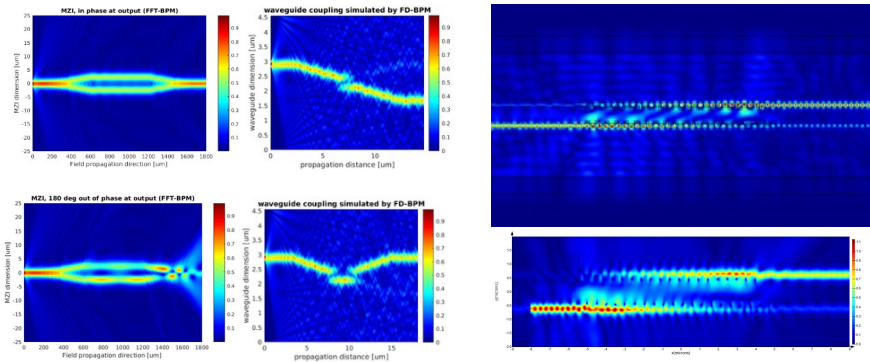

Fundamentally new interlayer coupler to achieve efficient and broadband coupling. Simulated by MEEP 3D FDTD.

Project 3: Fabrication and Testing of Rectangular Fiber Grating Coupler and GARC Coupler
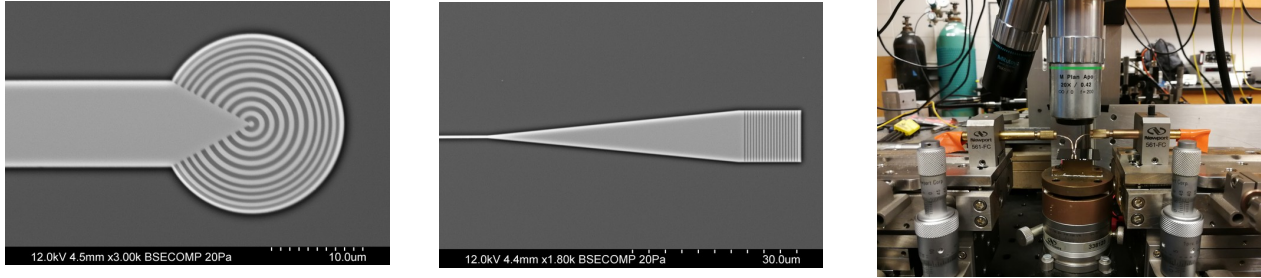
Side Projects: FDTD, FEM, and BPM Simulations   Previous Project: CNT FET

Self-coded FFT-BPM and FD-BPM   COMSOL FEM (top) and Lumerical FDTD solutions (bottom)