

# CONGSHAN WAN

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## EDUCATION

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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

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**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 coding, 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) Inter-layer 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 novel multiple-use self-aligned fiber/fiber array alignment fixture to achieve easy vertical or butt coupling
- 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<sub>2</sub> nanoparticles and performed surface plasma resonance analysis
- Synthesized block-copolymer chains on star-like micro-initiators as bi-phased and spherical nanoparticle scaffolds

**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 transferred 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

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**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<sub>2</sub> 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

- Deposited TaO<sub>x</sub> thin films by reactive RF magnetron sputtering using a Ta target in oxygen ambient and controlled oxygen profile of TaO<sub>x</sub> 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

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### 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<sub>2</sub> 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

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### Software and Programming Skills:

Matlab, LabVIEW, COMSOL, Lumerical (FDTD, MODE, DEVICE, INTERCONNECT), MEEP FDTD, Zemax, SAS JMP, ANSYS, Autocad, Solidworks, GenISys 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)

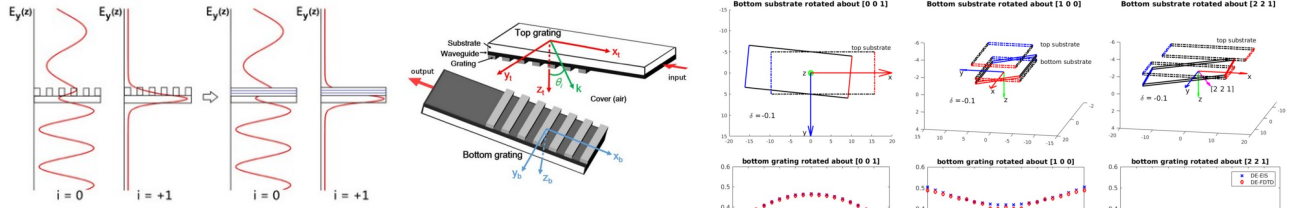
### Microfabrication and Microscopy Techniques:

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

## PROJECT OVERVIEW

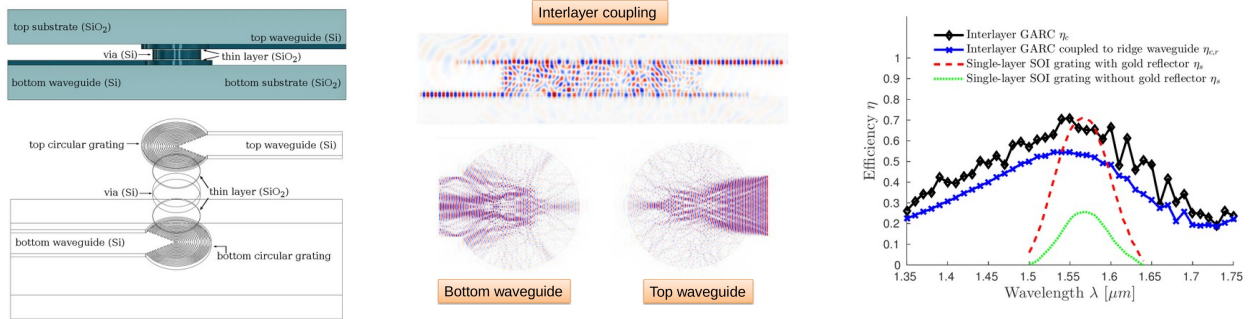
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### Project 1: Efficiency Optimization and Angular Misalignment Analysis of Interlayer Grating Couplers



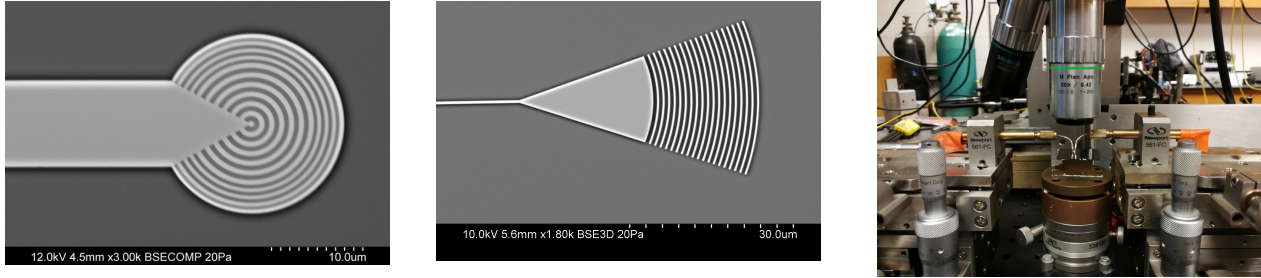
New “equivalent-index-slabs” concept to assist rigorous coupled-wave analysis (RCWA) in analyzing waveguide gratings involving surface waves and angular misalignment. Code implemented in Matlab.

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

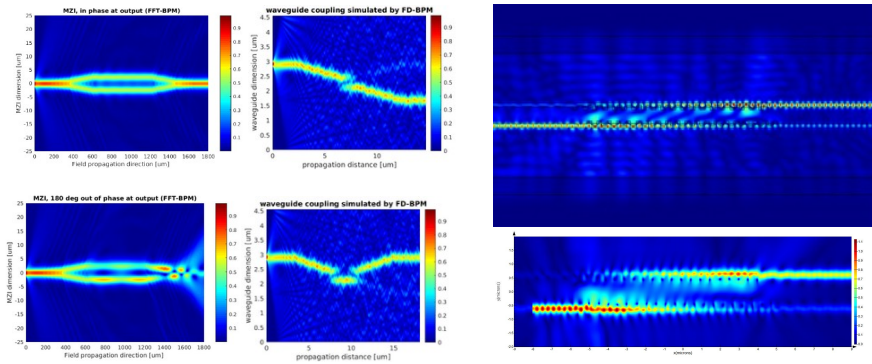


Fundamentally new interlayer coupler to achieve efficient and broadband coupling. Simulated by MEEP 3D FDTD.

### Project 3: Fabrication and Testing of 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

