

# GANG QIAN, PH.D.

US CITIZEN

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## SUMMARY OF QUALIFICATIONS

Over 10 years of hands-on experience on design, synthesis, and characterization of organic small molecules and polymers. Expertise in organic chemistry, material separation, purification, and characterization. Over 4 years of hands-on experience on formulation of photo or thermal curable resins, e.g., acrylate, epoxy, and urethane, for the applications of adhesive or 3D printing. Deeply understand the relationship between structure and material properties. Strong experience in thin film deposition and characterization. Self-motivated and detail-oriented researcher, have published more than 20 peer-reviewed journal papers (13 first-authored).

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## SKILLS AND TECHNIQUES

- 10+ years of hands-on experience on design, synthesis and characterization of organic small molecules and polymers, inorganic quantum dots and surface modification.
- 10+ years of hands-on experience on separation and purification: distillation, sublimation, recrystallization, thin layer and column chromatography, precipitation, centrifugation, dialysis.
- 10+ years of hands-on experience on characterization: NMR, FTIR, GPC, HPLC, EPR, TGA, DSC, DEA, and CV.
- 10+ years of hands-on experience on thin film deposition and characterization: high vacuum vapor deposition, sputtering, spin-coating and drop-casting; surface profilometer, ellipsometer, AFM, XRD, SEM and TEM.
- 5+ years of hands-on experience on devices fabrication and testing: organic light emitting diodes (OLEDs), organic photovoltaic solar cells (OPVs), light emitting electrochemical cells (LECs), fluorescent chemosensors and photodetectors.
- Broad knowledge and experience on the color science and optical properties: UV-vis-NIR, photoluminescence, electroluminescence, and electrochromism.
- Expertise in DOE/statistical analysis.
- Extensive skills in data acquisition and analysis: Minitab, LabVIEW and MATLAB.

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## WORKING EXPERIENCE

### NEW IRIDIUM, FORT COLLINS, CO

Apr 2021 – Present

Lead Scientist

#### Specific job duties:

- Photocatalysis for aryl-aryl cross-couplings, C(sp<sup>3</sup>)-H activation, and CO<sub>2</sub> utilization.
- Flow reactor for reaction optimization.
- High-throughput experimentation (HTE) for organic synthesis methodology.

### DREVE AMERICA, EDEN PRAIRIE, MN

Jun 2018 – Apr 2021

Sr. Polymer Chemist

#### Specific job duties:

- Completed substitution of TPO with non CMR photoinitiator system for existing products
- Successfully improved surface degree of cure and reduced leaching without inert gas protection
- Drastically reduced yellowing index and improved color stability of UV curable resins
- Explored dual cure system, e.g., acrylate/epoxy, acrylate/thiol-ene, and acrylate/urethane system

### 3M, MAPLEWOOD, MN

Mar 2017 – Mar 2018

Lab Research Chemist

#### Specific job duties:

- Formulating and evaluating of thermal and UV curable resin (e.g., acrylate and epoxy) for adhesives
- Formulating of monomer/polymer and silica composites for anti-reflection, anti-soiling and abrasion resistance coatings
- Improving bonding strength of fluoropolymer and metal surface (e.g., stainless steel)

UNIVERSITY OF MINNESOTA, Minneapolis, MN

Jul 2014 – Aug 2016

Research Associate working with Prof. Russell J. Holmes and Prof. Edward L. Cussler in Chemical Engineering and Materials Science department

**Major achievements:**

- Elucidated the degradation mechanism of single emissive layer OLED device with impurities in hole transporting layer
- Developed fundamental understanding on the material transport regime in high temperature sublimation and the relationship of material decomposition versus temperature

UNIVERSITY OF MASSACHUSETTS AMHERST, Amherst, MA

Jan 2012 – Apr 2014

Research Associate working with Prof. James J. Watkins in Polymer Science and Engineering department

**Major achievements:**

- Demonstrated saturated and multicolored light-emitting electrochemical cells based on size tunable CdSe quantum dots and polymer nanocomposites (Collaborated with QD Vision Inc.)
- Realized transparent and flexible light-emitting electrochemical cells by utilizing transparent silver nanowire composite electrode and flexible PET substrate
- Developed low-cost and universal method to improve power conversion efficiency of organic photovoltaic solar cells through interfacial engineering

CARLETON UNIVERSITY, Ottawa, Ontario

Feb 2009 – Jan 2012

Research Associate working with Prof. Wayne Zhi Yuan Wang in Chemistry department

**Major achievements:**

- Synthesized low band-gap conjugated polymers and evaluated their performance in near-infrared organic light-emitting diodes, organic photovoltaic solar cells, and photodetectors
- Created near-infrared thermochromic, electrochromic, halochromic, and halofluoric organic small molecules and polymers
- Demonstrated wavelength tunable near-infrared chemiluminescence through energy transfer from chemical reaction to fluorophor

CHINESE ACADEMY OF SCIENCES, Changchun, China

Sep 2003 – Jan 2009

Graduate Student – Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

**Major achievements:**

- Synthesized low band-gap organic conjugated small molecules and polymers through intramolecular charge transfer
- Established fundamental structure-properties relationship
- Demonstrated high-efficient non-doped near infrared organic light-emitting diodes with emission wavelength over 1000 nm
- Devised highly selective, sensitive, and reliable organic fluorescent chemosensors for selective detection of cyanide and fluoride

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## EDUCATION

CHINESE ACADEMY OF SCIENCES, Changchun Institute of Applied Chemistry, Changchun, China

2009

**Ph.D. in Polymer Chemistry and Physics** GPA: 3.6/4.0

**Thesis:** The Design, Synthesis and Characterization of Donor-Acceptor Type Near-Infrared Organic Materials

SOUTHEAST UNIVERSITY, Nanjing, China

2003

**B.S. in Chemical Science and Engineering**

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## PUBLICATIONS

- [1] **Qian, Gang;** Wang, Zhi Yuan. "Near-Infrared Organic Compounds and Emerging Applications," *Chem. Asian. J.* **2010**, 5, 1006-1029. (Invited review)

- [2] **Qian, Gang**; Dai, Bo; Luo, Min; Yu, Deng Bin; Zhan, Jie; Zhang, Zhi Qiang; Ma, Dong Ge; Wang, Zhi Yuan. "Band-Gap Tunable, Donor-Acceptor-Donor Charge-Transfer Heteroquinoid-Based Chromophores: Near-Infrared Photoluminescence and Electroluminescence," *Chem. Mater.* **2008**, 20, 6208-6216.
- [3] **Qian, Gang**; Zhong, Ze; Luo, Min; Yu, Deng Bin; Zhang, Zhi Qiang; Wang, Zhi Yuan; Ma, Dong Ge. "Simple and Efficient Near-Infrared Organic Chromophores for Light-Emitting Diodes with Single Electroluminescent Emission above 1000 nm," *Adv. Mater.* **2009**, 21, 111-116. (Highlighted by Nature Asia Materials)
- [4] **Qian, Gang**; Wang, Zhi Yuan. "Near-Infrared Thermochromic Diazapentalene Dyes," *Adv. Mater.* **2012**, 24, 1582-1588.
- [5] **Qian, Gang**; Lin, Ying; Wantz, Guillaume; Davis, Andrew R.; Carter, Kenneth R.; Watkins, James J. "Saturated and Multi-colored Electroluminescence from Quantum Dots Based Light Emitting Electrochemical Cells," *Adv. Funct. Mater.* **2014**, 24, 4484-4490.
- [6] **Qian, Gang**; Qi, Ji; Davey, A. James; Wright, S. James; Wang, Zhi Yuan. "A Family of Diazapentalene Chromophores and Narrow Band-Gap Polymers: Synthesis, Halochromism, Halofluorism, and Visible Near-Infrared Photodetectivity," *Chem. Mater.* **2012**, 24, 2364-2372.
- [7] **Qian, Gang**; Gao, Jian Ping; Wang, Zhi Yuan. "Near-Infrared Chemiluminescence Tunable from 900 nm to 1700 nm from Narrow-Bandgap Compounds and Polymers," *Chem. Commun.* **2012**, 48, 6426-6428.
- [8] **Qian, Gang**; Qi, Ji; Wang, Zhi Yuan. "Synthesis and Study of Low Band-Gap Polymers Containing the Diazapentalene and Diketopyrrolopyrrole Chromophores for Potential Use in Solar Cells and Near-Infrared Photodetectors," *J. Mater. Chem.* **2012**, 22, 12867-12873.
- [9] **Qian, Gang**; Abu, Hana; Wang, Zhi Yuan. "A Precursor Strategy for the Synthesis of Low Band-Gap Polymers: An Efficient Route to a Series of Near-Infrared Electrochromic Polymers," *J. Mater. Chem.* **2011**, 21, 7678-7685.
- [10] **Qian, Gang**; Li, Xian Zhen; Wang, Zhi Yuan, "Visible and Near-Infrared Chemosensor for Colorimetric and Ratiometric Detection of Cyanide," *J. Mater. Chem.* **2009**, 19, 522-530.
- [11] **Qian, Gang**; Wang, Zhi Yuan, "Design, Synthesis, and Properties of Benzobisthiadiazole-Based Donor-Pi-Acceptor-Pi-Donor Type of Low-Band-Gap Chromophores and Polymers," *Can. J. Chem.* **2010**, 88, 192-201.
- [12] **Qian, Gang**; Zhong, Ze; Luo, Min; Yu, Dengbin; Zhang, Zhiqiang; Ma, Dongge; Wang, Zhi. Yuan, "Synthesis and Application of Thiadiazoloquinoxaline-Containing Chromophores as Dopants for Efficient Near-Infrared Organic Light-Emitting Diodes," *J. Phys. Chem. C* **2009**, 113, 1589-1595.
- [13] **Qian, Gang**; Morgan, Nathan T.; Holmes, Russell J.; Cussler, Edward L.; Blaylock, Wayne D.; Froese, Robert D. J. "Sublimation as a function of diffusion," *AIChE J.* **2016**, 62, 861-867.
- [14] Li, Duo; **Qian, Gang**; Wang, Zhi Yuan. "Synthesis and Characterization of Low Band Gap Thiadiazolobenzimidazole Chromophores," *Synth. Met.* **2014**, 189, 26-33.
- [15] Li, Duo; **Qian, Gang**; Wang, Zhi Yuan. "Synthesis and Characterizations of Conjugated Copolymers Containing Benzo[f]isoindole-1,3-dione and Diketopyrrolopyrrole Units," *Polymer*, **2013**, 54, 5543-5552.
- [16] Xuan, Yu; **Qian, Gang**; Wang, Zhi. Yuan; Ma, Dong. Ge, "Near-Infrared Polymer Light-Emitting Diodes Based on Infrared Dye Doped Poly(N-Vinylcarbazole) Film," *Thin Solid Films* **2008**, 516, 7891-7893.
- [17] Zhou, Gang; **Qian, Gang**; Ma, Liang; Cheng, Yanxiang; Xie, Zhiyuan; Wang, Lixiang; Jing, Xiabin; Wang Fosong, "Polyfluorenes with Phosphonate Groups in the Side Chains as Chemosensors and Electroluminescent Materials," *Macromolecules* **2005**, 38, 5416-5424.
- [18] Hershey, Kyle W.; Bangsund, John S.; **Qian, Gang**. "Decoupling degradation in exciton formation and recombination during lifetime testing of organic light-emitting devices," *Appl. Phys. Lett.* **2017**, 111, 113301.
- [19] Lin, Ying; Wang, Xinyu; **Qian, Gang**; Watkins, James J. "Additive-Driven Self-Assembly of Well-Ordered Mesoporous Carbon/Iron Oxide Nanoparticle Composites for Supercapacitors," *Chem. Mater.* **2014**, 26, 2128-2137.
- [20] Lin, Ying; Wei, Qingshuo; **Qian, Gang**; Yao, Li; Watkins, James J. "Morphology Control in TiO<sub>2</sub> Nanopod/Polythiophene Composites for Bulk Heterojunction Solar Cells Using Hydrogen Bonding," *Macromolecules*, **2012**, 45, 8665-8673.
- [21] Hao, Wenhui; Wang, Cheng; **Qian, Gang**; Wang, Zhi Yuan. "(Z)-1,1-Dicyano-2-(4-Fluorophenyl)-3-(1-

Hexylpyridin-1-ium-4-yl) prop-2-en-1-ide,” *Acta Crystallographica Section E: Structure Reports Online*, **2011**, 68, o82-o82.

- [22] Luo, Min; Shadnia, Hooman; **Qian, Gang**; Du, Xiao. Bo; Yu, Deng. Bin; Ma, Dong. Ge; Wright, James. S.; Wang, Zhi Yuan. "Rational Design, Synthesis, and Optical Properties of Film-Forming, near-Infrared Absorbing, and Fluorescent Chirromophores with Multidonors and Large Heterocyclic Acceptors," *Chem. Eur. J.* **2009**, 15, 8902-8908.
- [23] Grigalevicius, Saulius; Ma, Liang; **Qian, Gang**; Xie, Zhiyuan; Forster, Michael; Scherf, Ullrich, "New CarbazoleBased Copolymers as Amorphous Hole-Transporting Materials for Multilayer Light-Emitting Diodes," *Macromol. Chem. Phys.* **2007**, 208, 349-355.
- [24] Sun, Hai Zhu; Zhang, Hao; Ju, Jie; Zhang, Jun. Hu; **Qian, Gang**; Wang, Chunlei; Yang, Bai; Wang, Zhi. Yuan, "One-Step Synthesis of High-Quality Gradient Cdhgte Nanocrystals: A Prerequisite to Prepare Cdhgte-Polymer Bulk Composites with Intense Near-Infrared Photoluminescence," *Chem. Mater.* **2008**, 20, 6764-6769.
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### PATENTS

- [1] US patent: 80614US002, Naiyong Jing, Tho Q. Nguyen, **Gang Qian**, "Fluorinated Polymer Coating Compositions and Articles Therefrom"
- [2] US patent application: 2022P00022 US, Chern-Hooi Lim, **Gang Qian**, William Zachary Elder, Paige Riley, "Use of a Catalyst Composition for Biaryl Synthesis by Decarboxylative Cross-coupling"
- [3] US patent application: 2022P00023 US, Chern-Hooi Lim, **Gang Qian**, William Zachary Elder, Paige Riley, "Catalyst Composition for Biaryl Synthesis by Decarboxylative Cross-coupling"
- [4] PCT international application number: PCT/US2022/037417, Takuya Suguri, Youichirou Maruyama, Chern-Hooi Lim, **Gang Qian**, Yue Liu, Elana Cope, "Photocatalytic Synthesis of  $\alpha$ ,  $\beta$ -Unsaturated Carbonyl Compounds and Their Intermediates"
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### SELECT ORAL PRESENTATIONS

- [1] **Qian, Gang**; Lin, Ying; Wantz, Guillaume; Davis, Andrew; Carter, Kenneth R.; Watkins, James J. "Color Saturated Electroluminescence from Quantum Dot Based Light Emitting Electrochemical Cells," Paper N5.05, MRS 2013 Fall Meeting, Boston, MA. (December 2013)
- [2] **Qian, Gang**; Abu, Hana; Wang, Zhi Yuan. "Near-Infrared Functional Organic Materials," 94th Canadian Chemistry Conference and Exhibition, Montréal, Québec, Canada. (June 2011)
- [3] **Qian, Gang**; Wang, Zhi Yuan. "Tunable Donor-Acceptor Type Near-Infrared Organic Materials for Electroluminescent and Electrochromic Applications," 34th Canadian High Polymer Forum, Ste-Adèle, Québec, Canada. (August 2010)