# Qichao Ruan

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## Education

**Shanghai Institute of Ceramics**, Chinese Academy of Sciences (CAS) Shanghai, China
Ph.D.,Material Science 2011
**Wuhan University of Science and Technology** Wuhan, China
B.S., Materials of Science and Engineering 2006
**Wuhan University of Science and Technology** Wuhan, China
B.B.A.,Business Administration 2006

## Research Experience

**Research Associate, *University of Southern California*,** CA, USA 2011-present
Principal Investigator: Dr. Janet Moradian-Oldak

- Development of novel biomimetic strategies for tooth repair
  - Developed the amelogenin-chitosan hydrogel for enamel reconstruction
  - Developed amelogenin-derived peptides for rebuilding enamel on both enamel and dentin surfaces
  - Investigated the efficacy of amelogenin-chitosan hydrogel in biomimetic repair of human enamel in pH-cycling systems
  - Developed the biomimetic layered chitosan-monetite composite as a potential bulk material for dental application

**Research Assistant, *Shanghai Institute of Ceramics*,** Shanghai, China 2006-2011
Principal Investigator: Dr. Yingchun Zhu

- Biomimetic design and assembly of the orderly layered microstructure for biomedical applications
  - Synthesized the bioactive orderly layered monetite (anhydrous calcium hydrogen phosphate) utilizing a sonochemical-assisted method
  - Prepared the ordered heparin/chitosan multilayer film by LbL (layer-by-layer) methods and investigated the buildup mechanism of LbL film
  - Studied the cell cytotoxicity of related materials
  - Investigated the smart systems for controlled drug release

**Research Assistant, *Wuhan University of Science and Technology*,** Hubei, China 2005-2006
Principal Investigator: Dr. Huizhong Zhao

- Preparation and sintering of ultra-fine Tetragonal ZrO2–CeO2 (CeSZ) powder
  - Synthesized ultra-fine CeSZ nanopowders using the co-precipitation method combined with supercritical fluid drying (SCFD) technique.
  - Investigated of spark-plasma-sintering (SPS) properties of the CeSZ nanopowders

## Referee for Scientific Journals

*Acta Biomaterialia, Materials & Design, Materials Science and Engineering C, RSC Advances, Journal of Crystal Growth, Journal of Materials Science: Materials in Medicine, European Journal of Oral Sciences, International Journal of Oral Science, International Journal of Biomaterials, Minerals, Physical Biology, Journal of Restorative and Esthetic Dentistry, Dental Research & Management Journal, Journal of Nanomaterials, Current Nanoscience.*

**Editorial Board of Scientific Journals**

*Journal of Biomedical Engineering and Informatics, Sciedu Press*

*Gavin Journal of Dental Sciences, Gavin Publishers*

**Awards and Achievements**

1. Postdoctoral Scholar Travel and Training Award, 2016, University of Southern California
2. Outstanding Reviewer, 2015, Acta Biomaterialia.
3. Most Innovative Award, 2014, The USC Steven Institute for Innovation, University of Southern California
4. Young Investigators Award, 11th International Conference on the Chemistry and Biology of Mineralized Tissues, 2013, Lake Geneva, USA
5. The 2nd Place Graduate Post-Doctoral Trainee Award, 2012, Ostrow School of Dentistry of USC
6. First-rate scholarship for college students(once), second-rate scholarship(once), third-rate scholarship (four times) 2002-2006; PuNai scholarship in 2002; Laiwu Steel scholarship in 2006
7. Excellent Award for outstanding student leaders in WUST 2003
8. Excellent Student in WUST 2004, 2005, 2006
9. Excellent Graduation Thesis in Hubei Province, 2006, China

**Communication and Experimental skills**

- o Strong written and verbal communication skills
  - Published 25 research papers in international, peer-reviewed journals
  - Gave both oral and poster presentations at several national and international conferences
- o Experimental skills relating to the synthesis of biomedical materials
  - Nanomaterial synthesis and assembly based on wet chemical methods
  - Solution-based processing of films: spin casting, dip coating and layer-by-layer assembly
  - Experience in recombinant protein expression (in *Escherichia coli* system) and purification (HPLC).
- o Experimental skills relating to the materials characterization and evaluation
  - Compositional analysis: XRD, EDX, XPS, FTIR, Raman, TGA, and DSC.
  - Microstructural analysis: Optical Microscopy, SEM, TEM and AFM
  - Mechanical testing: Nanoindentation, Microhardness test, and Compressive test
  - Protein structure and interaction: DLS, CD, Fluorescence spectroscopy
  - Experience in evaluation of biocompatibility of biomaterials
  - Experience in electrochemical characterization: Cyclic Voltammetry and Electrochemical Impedance Spectroscopy

**Publications**

1. **Qichao Ruan**, David Liberman, Yuzheng Zhang, Dongni Ren, Yunpeng Zhang, Steven Nutt, and Janet Moradian-Oldak. Assembly of Layered Monetite-Chitosan Nanocomposite and Its Transition to Organized Hydroxyapatite, ***ACS Biomaterials Science & Engineering,*** 2016, 2 (6), 1049–1058.
2. **Qichao Ruan**, David Liberman, Karthik Balakrishna Chandrababu, Jin-Ho Phark, and Janet Moradian-Oldak. Efficacy of amelogenin-chitosan hydrogel in biomimetic repair of human enamel in pH-cycling systems, ***Journal of Biomedical Engineering and Informatics***, 2016, 2(1), 119-128.
3. Kaushik Mukherjee, **Qichao Ruan**, David Liberman, Shane White, and Janet Moradian-Oldak. Reconstructing Human Tooth Enamel with LRAP-chitosan hydrogel, ***Journal of Materials Research,*** 2016, 31(5), 556-563. (**Cover Story**)
4. Dongni Ren, **Qichao Ruan**, Jinhui Tao, Jonathan Lo, Steven Nutt and Janet Moradian-Oldak. Amelogenin affects brushite crystal morphology and promotes its phase transformation to monetite,

***Crystal Growth & Design,*** 2016, 16(9), 4981-4990.

5. Saumya Prajapati, Jinhui Tao, **Qichao Ruan**, James J. DeYoreo and Janet Moradian-Oldak. Matrix metalloproteinase-20 mediates dental enamel biomineralization by preventing protein occlusion inside apatite, ***Biomaterials,*** 2015, 75, 260-270.
6. **Qichao Ruan,** and Janet Moradian-Oldak. Amelogenin and enamel biomimetics, ***Journal of Materials Chemistry B***, 2015, 3, 3112-3129. (Marked as **Hot Paper**)
7. **Qichao Ruan,** Nadia Siddiqah, Xiaochen Li, Steven Nutt, and Janet Moradian-Oldak. Amelogenin-chitosan matrix for human enamel regrowth: effects of viscosity and supersaturation degree, ***Connective Tissue Research***, 2014, S1, 150-154.
8. **Qichao Ruan,** and Janet Moradian-Oldak. Development of amelogenin-chitosan hydrogel for in vitro enamel regrowth with a dense interface, ***Journal of Visualized Experiments***, 2014, 89,e51606, doi:10.3791/51606.
9. **Qichao Ruan,** Yuzheng Zhang, Xiudong Yang, Steven Nutt, and Janet Moradian-Oldak. Amelogenin-chitosan matrix promotes assembly of an enamel-like layer with a dense interface, ***Acta Biomaterialia***, 2013, 9, 7289-7297.
10. Fang Li, Yingchun Zhu,Zhiyong Mao, Yunli Wang, **Qichao Ruan,** Jianlin Shi, Congqing Ning. Macromolecules on Nano-outlets Responding to Electric Field and pH for Dual-mode Drug Delivery. ***Journal of Materials Chemistry B***, 2013, 1, 1579-1583.
11. Junwu Xiao, Yingchun Zhu, **Qichao Ruan,** Yanyan Liu, Yi Zeng, Fangfang Xu, Linlin Zhang. Biomacromolecule and Surfactant Complex Matrix for Oriented Stack of 2-Dimensional Carbonated Hydroxyapatite Nanosheets as Alignment in Calcified Tissues. ***Crystal Growth & Design***, 2010, 10, 1492-1499.
12. Tao Yang, Yingchun Zhu, **Qichao Ruan,** Xuefeng Du, Yi Zeng, Fangfang Xu. Synthesis of h-AlN Nanowires via Carbothermal Reduction and Nitridation Methods Using Acetylene Black. ***Journal of Nanoscience and Nanotechnology,*** 2010, 10, 421-425.
13. Yingchun Zhu, Huijuan Liu, Fang Li, **Qichao Ruan,** Hua Wang, Masahiro Fujiwara, Lianzhou Wang, G. Q.(Max) Lu. Dipolar Molecules as Propellers Achieving Electric Field Stimulated Release. ***Journal of the American Chemical Society,*** 2010, 132, 1450-1451.
14. Junwu Xiao, Yingchun Zhu,Jianhui Yuan, **Qichao Ruan,** Yi Zeng, Lifang Chen, Lianzhou Wang, Fangfang Xu. Polymorph Selection of Calcium Carbonate by the Morphology of Biomacromolecules: From Aragonite, Vaterite to Calcite. ***Materials Research Bulletin,*** 2010, 23, 3695-3706.
15. Zhen Liu, Yingchun Zhu,Jianhui Yuan, **Qichao Ruan,**Guohong Ma. Preparation and Characterization of ZnSeTetrapods with Sphalerite Nucleus. ***Journal of Inorganic Materials,*** 2010, 25, 216-220.
16. Fang Li, Yingchun Zhu, Bo You, Donghui Zhao, **Qichao Ruan,** Yi Zeng, Chuanxian Ding. Smart Hydrogels co-Switched by Hydrogen Bond and π-π Stacking for Continuously Regulated Controlled-Release System. ***Advanced Functional Materials,*** 2010, 20, 669-676.
17. Yunli Wang, Yingchun Zhu,Yanyan Liu, Yu Yang, **Qichao Ruan,** Fangfang Xu. An Effective Gold Nanotubes Electrode for Amperometric Biosensor. ***Journal of Nanoscience and Nanotechnology,*** 2010, 10, 8286-8292.
18. Jianhui Yuan, Yingchun Zhu,Hengji, Xuebing Zheng, **Qichao Ruan,** YaranNiu, Ziwei Liu, Yi Zeng. Microstructures and tribological properties of plasma sprayed WC-Co-Cu-BaF2/CaF2 self-lubricating wear resistant coatings. ***Applied Surface Science,*** 2010, 256, 4938-4944.
19. Donghui Zhao, Yingchun Zhu, Fang Li, Shengmao Zhang, Linlin Zhang, FushanLv, Sheng Li, **Qichao Ruan,**Fangfang Xu. Polymorph Selection and Nanocrystallite Rearrangement of Calcium Carbonate in Carboxymethyl Chitosan Aqueous Solution: Thermodynamic and Kinetic Analysis. ***Materials Research Bulletin***, 2010, 45, 80-87.
20. **Qichao Ruan,**Yingchun Zhu, Yi Zeng, Huofei Qian, Junwu Xiao, Fangfang Xu, Linlin Zhang, Donghui Zhao. Ultrasonic-Irradition-Assisted Oriented Assembly of Ordered Monetite Nanosheets Stacking, ***The Journal of Physical Chemistry B***, 2009, 113, 1100-1106.

21. **Qichao Ruan**, Yingchun Zhu, Fang Li, Junwu Xiao, Yi Zeng, Fangfang Xu. Investigation of Layer-by-layer Assembled Heparin and Chitosan Multilayer Films via Electrochemical Spectroscopy, ***Journal of Colloid and Interface Science***, 2009, 333, 725-733.
22. Yingchun Zhu,**Qichao Ruan,**Fangfang Xu. Crystallographically-Oriented Nanoassembly by ZnSTricrystals and Subsequent Three-Dimensional Epitaxy. ***Nano Research,*** 2009, 2, 688-694.
23. Yingchun Zhu,Yanyan Liu, **Qichao Ruan,** Yi Zeng, Junwu Xiao, Ziwei Liu, Lifang Cheng, Fangfang Xu, Linlin Zhang. Superstructures and Mineralization of Laminated VateriteMesocrystals via Mesoscale Transformation and Self-Assembly, ***The Journal of Physical chemistry C,*** 2009, 113, 6584-6588.
24. Huijuan Liu, Yingchun Zhu,**Qichao Ruan,** Yi Zeng, Fangfang Xu, Xiue Ren, DongfengXue. Synthesis and Analysis of Hydroxyapatite Nanosheets with Oriented Arrangement. ***Journal of the Chinese Ceramic Society***, 2009, 37, 1495-1499.
25. Jianhui Yuan, Yingchun Zhu,Xuebing Zheng, **Qichao Ruan,**Hengji. Improvement in TribologicalProperties of Atmospheric Plasma-Sprayed WC–Co Coating Followed by Cu Electrochemical Impregnation. ***Applied Surface Science,*** 2009, 255, 7959-7965.

## Presentations

1. 25th AACGE Western Section Conference on Crystal Growth &Epitaxy, 2016, Fallen Leaf Lake, California, USA. **Oral presentation (invited talk)**: “Strategies for Biomimetic Tooth Repair”.
2. AADR/CADR Annual Meeting, 2016, Los Angeles, USA. **Oral presentation**: “Layered Monetite-Chitosan Composite for Synthesis of Hierarchical Enamel-mimetic Structure”.
3. IADR/AADR/CADR General Section, 2015, Boston, USA. **Poster presentation**: “Amelogenin-chitosan Hydrogel for Enamel Regrowth: An in Vitro pH-cycling Study”.
4. 87th ACS Colloid & Surface Science Symposium, 2013, Riverside, USA. **Oral Presentation**: “Amelogenin-chitosan hydrogel for enamel reconstruction via protein-directed assembly with a dense interface”.
5. 11th International Conference on the Chemistry and Biology of Mineralized Tissues, 2013, Lake Geneva, USA. **Oral Presentation**: “Amelogenin-Chitosan Matrix Forms an Organized Mineralized Layer with a Dense Interface”.
6. Gordon Research Conference on Biomineralization, 2012, New Hampshire, USA. **Poster presentation**: “Amelogenin-Chitosan Hydrogel for Enamel Reconstruction”.

## Patents

1. **Qichao Ruan,**Janet Moradian-Oldak.“Chitosan -Amelogenin Hydrogel for In Situ Enamel Growth”, Patent Application, **US 20140186273 A1.**
2. **Qichao Ruan,** Kaushik Mukherjee, Janet Moradian-Oldak. “Amelogenin-chitosan hydrogel for dentin Hypersensitivity”, Patent Application, **US 20170007737 A1.**
3. Yingchun Zhu, **Qichao Ruan.** “Ultrasonic Auxiliary Production of Monetite with Ordered Lamellar Structure and Method for Producing the Same”, Application No.: **200810203916.1**, Publication No.:**CN101428778.**
4. Yingchun Zhu, **Qichao Ruan,**Junwu Xiao. “Plate-like Phosphoric Acid Calcium Salt and Preparation Method and Application Thereof”, Application No.:**200910049369.0**, Publication No.: **CN101538028.**
5. Yingchun Zhu, **Qichao Ruan.** “Enamel-Shaped Hydroxyapatite and Preparation Method and Application Thereof”, Application No.: **201010221709.6**, Publication No.:**CN101891175A.**
6. Yingchun Zhu, **Qichao Ruan.** “Preparation and Application of Porous Hydroxyapatite”, Application No.: **201010221708.1**, Publication No.:**CN101880034A.**
7. Yingchun Zhu, Fang Li, **Qichao Ruan,** “Dipolar Molecule-Modified Mesoporous Silicon Material, Preparation and Application Thereof”, Application No.:**200910147729.8**, Open No.:**CN101766816A**; International Application No.: **PCT/CN2010/080479**, Publication No.: **WO/2011/079800**.