Bocong Zheng

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Appointment

Jan. 2018-Present	**Fraunhofer USA Inc.**	**Scientist**
	Center for Coatings and Diamond Technologies	
Jan. 2017-Dec. 2017	**Michigan State University**	**Postdoctoral Fellow**
	Department of Electrical and Computer Engineering	

Education

Sep. 2009-May 2016	**Dalian University of Technology**	**Surface Engineering**	**Ph.D.**
Sep. 2005-Jul. 2009	**Dalian Maritime University**	**Material Sci. & Eng.**	**B.Eng.**

Referee Service

Journal of Applied Physics

Journal of Physics D

Physics of Plasmas

Review of Scientific Instruments

Vacuum

Crystal Growth & Design

Plasma

Current Research

2019-2021 Research Project: **Developing an Efficient Computation Scheme for Modeling Low-Pressure Plasmas.**

Funded by National Science Foundation (NSF), $250,000, in collaboration with MSU.

2019-2020 Research Project: **Single Beam Ion Sources for Advanced Materials Processing.**

Funded by National Science Foundation (NSF) Small Business Innovation Research (SBIR) Program, $225,000, with Fraunhofer subawards from MSU.

2019-2020 Research Project: **Plasma Sources with Broad Range of Ion Energies for Thin Film Processing.**

Funded by Michigan Translational Research and Commercialization (MTRAC), $100,000, with Fraunhofer subawards from MSU.

2017-2020 Research Project: **Resolving Abnormal Target Erosion in High Frequency Magnetron Discharge.**

Funded by National Science Foundation (NSF), $300,000, in collaboration with MSU.

Research Experience

2018-2019 Research Project: **Development of Scalable Linear Ion Sources for Thin Film Processing.**

Funded by Michigan Economic Development Corporation (MEDC) / Michigan State University (MSU) Advanced Grant, $80,000, with Fraunhofer subawards from MSU.

2018-2019 Research Project: **High-Density Plasma Technologies for Efficient Manufacturing of Activated Carbon.**

Funded by Michigan Translational Research and Commercialization (MTRAC), $100,000, with Fraunhofer subawards from MSU.

2016-2019 Research Project: **Using Plasma Electrolysis for Efficient Manufacturing of Nanoparticles.**

Funded by National Science Foundation (NSF), $315,597, in collaboration with MSU.

2016-2019 Research Project: **High-density Plasma for Efficient Manufacturing of Electronic Devices.**

Funded by National Science Foundation (NSF), $243,726, in collaboration with MSU.

2009-2016 Doctoral Thesis: **Numerical study on the plasma-surface interaction in pulsed plasma processings**

- Develop fluid models and global models for pulsed plasma processings.
- Investigate the impact factors on discharge characteristics of high-power impulse magnetron sputtering and plasma-based ion implantation.

Research interests

- **Plasma simulation:** Particle-in-cell simulations; fluid dynamics; plasma global model
- **Gas discharge physics:** electron power absorption; electron kinetics; discharge dynamics
- **Physical vapor deposition:** magnetron sputtering discharges; ion sources
- **Radio frequency discharges:** capacitively coupled plasmas; inductively coupled plasmas

Publications

Patent:

[1] Qi Hua Fan, Thomas Schuelke, Michael Becker, and **Bocong Zheng**, "Magnetically enhanced and symmetrical radio frequency discharge apparatus for material processing". (US Patent application number: 16/520,464).

Journal Paper:

† as corresponding author

[1] Yangyang Fu†, **Bocong Zheng**†, De-Qi Wen, Peng Zhang, Qi Hua Fan, John P Verboncoeur, Similarity law and frequency scaling in low-pressure capacitive radio frequency plasmas, *Applied Physics Letters* 117, 204101 (2020).

[2] Yangyang Fu†, **Bocong Zheng**, Peng Zhang, Qi Hua Fan, John P Verboncoeur, Xinxin Wang, Similarity of capacitive radio-frequency discharges in nonlocal regimes, *Physics of Plasmas* 27, 113501 (2020).

[3] Yangyang Fu†, **Bocong Zheng**, De-Qi Wen, Peng Zhang, Qi Hua Fan, John P Verboncoeur, High-energy ballistic electrons in low-pressure radio-frequency plasmas, *Plasma Sources Science and Technology* 29, 09LT01 (2020).

[4] **Bocong Zheng**, Yangyang Fu, De-Qi Wen, Keliang Wang, Thomas Schuelke, Qi Hua Fan†, Influence of metastable atoms in low pressure magnetized radio-frequency argon discharges, *Journal of Physics D: Applied Physics* 53, 435201 (2020).

[5] Suihan Cui, Zhongzhen Wu, Shu Xiao, **Bocong Zheng**, Lei Chen, Tijun Li, Ricky K. Y. Fu, Paul K. Chu, Xiubo Tian, Wenchang Tan, Daining Fang, and Feng Pan, Nano-second temporal particle behavior in high-power impulse magnetron sputtering discharge in a cylindrical cathode, *Journal of Applied Physics* 127, 023301 (2020).

[6] Hui Chen, **Bocong Zheng**, Yixiang Ou, and Mingkai Lei†, Microstructure and thermal conductivity of Ti-Al-Si-N nanocomposite coatings deposited by modulated pulsed power magnetron sputtering, *Thin Solid Films*, 693, 137680 (2019).

[7] Madeline A. Mackinder, Keliang Wang, **Bocong Zheng**, Maheshwar Shrestha, and Qi Hua Fan†, Magnetic field enhanced cold plasma sterilization, *Clinical Plasma Medicine*, 17-18, 100092 (2019).

[8] **Bocong Zheng**, Maheshwar Shrestha, Keliang Wang, Thomas Schuelke, Evgeny Shun'ko, Veniamin Belkin, and Qi Hua Fan†, Reduction of capacitive coupling in inductively coupled plasmas by solenoid coils on dielectric window, *Journal of Applied Physics* 126, 123302 (2019).

[9] **Bocong Zheng**, Keliang Wang, Timothy Grotjohn, Thomas Schuelke, and Qi Hua Fan†, Enhancement of ohmic heating by hall current in magnetized capacitively coupled discharges, *Plasma Sources Science and Technology* 28, 09LT03 (2019).

[10] **Bocong Zheng**, Keliang Wang, Maheshwar Shrestha, Thomas Schuelke, and Qi Hua Fan†, Understanding the chemical reactions in cathodic plasma electrolysis, *Plasma Sources Science and Technology* 28, 085016 (2019).

[11] Keliang Wang†, **Bocong Zheng**, Madeline A. Mackinder, Nina Baule, Hui Qiao, Hong Jin, Thomas Schuelke, and Qi Hua Fan†, Graphene wrapped mxene via plasma exfoliation for all-solid-state flexible supercapacitors, *Energy Storage Materials* 20, 299-306 (2019).

[12] Suihan Cui, Zhongzhen Wu†, Hai Lin, Shu Xiao, **Bocong Zheng**, Liangliang Liu, Xiaokai An, Ricky K. Y. Fu, Xiubo Tian, Wenchang Tan, and Paul K. Chu, Hollow cathode effect modified time-dependent global model and high-power impulse magnetron sputtering discharge and transport in cylindrical cathode, *Journal of Applied Physics* 125, 063302 (2019).

[13] Hui Chen, **Bocong Zheng**, Yuge Li, Zhili Wu and Mingkai Lei†, Flexible hard Ti-Al-Si-N nanocomposite coatings deposited by modulated pulsed power magnetron sputtering with controllable peak power, *Thin Solid Films* 669, 377-386 (2019).

[14] **Bocong Zheng**, Zhili Wu†, Suihan Cui, Shu Xiao, Liangliang Liu, Hai Lin, Ricky K. Y. Fu, Xiubo Tian, Feng Pan†, and P. K. Chu, Discharge and deposition characteristics of high-power impulse magnetron sputtering using various target materials, **IEEE Transactions on Plasma Science** 47, 193-198 (2019).

[15] Keliang Wang†, **Bocong Zheng**, Maheshwar Shrestha, Thomas Schuelke, and Qi Hua Fan†, Magnetically enhanced plasma exfoliation of polyaniline-modified graphene for flexible solid-state supercapacitors, *Energy Storage Materials* 14, 230-237 (2018).

[16] **Bocong Zheng**, Thomas Schuelke, and Qi Hua Fan†, Acoustic standing wave modulation of capacitively coupled plasmas, *Journal of Physics D: Applied Physics* 51, 285201 (2018).

[17] Maheshwar Shrestha, Keliang Wang, **Bocong Zheng**, Laura Mokrzycki, and Qi Hua Fan†, Comparative study of furnace and flash lamp annealed silicon thin films grown by plasma enhanced chemical vapor deposition, *Coatings* 8, 97 (2018).

[18] Maheshwar Shrestha, Ishop Amatya, Keliang Wang, **Bocong Zheng**, Zhengrong Gu, and Qi Hua Fan†, Electrophoretic deposition of activated carbon yp-50 with ethyl cellulose binders for supercapacitor electrodes, *Journal of Energy Storage* 13, 206-210 (2017).

[19] Nezam Uddin, Maheshwar Shrestha, **Bocong Zheng**, Hyeun-Joong Yoon, Xiuqing Wang, and Qi Hua Fan†, Liquid sensors based on enhanced fabry-perot etalons, *IEEE Sensors Journal* 17, 22 (2017).

[20] **Bocong Zheng**, Zhili Wu, Bi Wu, Yuge Li, and Mingkai Lei†, A global plasma model for reactive deposition of compound films by modulated pulsed power magnetron sputtering discharges, *Journal of Applied Physics* 121, 171901 (2017).

[21] Suihan Cui, Zhongzhen Wu†, Shu Xiao, Liangliang Liu, **Bocong Zheng**, Hai Lin, Ricky K. Y. Fu, Xiubo Tian, Paul K. Chu, Wenchang Tan, and Feng Pan†, Electromagnetic control and optimization of high-power impulse magnetron sputtering discharges in cylindrical source, *Acta Physica Sinica* 66, 95203 (2017).

[22] Shu Xiao, Zhongzhen Wu†, Suihan Cui, Liangliang Liu, **Bocong Zheng**, Hai Lin, Ricky K. Y. Fu, Xiubo Tian, Feng Pan†, and Paul K. Chu, Cylindric high power impulse magnetron sputtering source and its discharge characteristics, *Acta Physica Sinica* 65, 185202 (2016).

[23] **Bocong Zheng**, Di Meng, Honglong Che, and Mingkai Lei†, On the pressure effect in energetic deposition of cu thin films by modulated pulsed power magnetron sputtering: A global plasma model and experiments, *Journal of Applied Physics* 117, 203302 (2015).

[24] **Bocong Zheng**, Kesheng Wang, Zhipeng Zhang, Honglong Che, and Mingkai Lei†, Nitrogen mass transfer models for plasma-based low-energy ion implantation, *Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films* 33, 021311 (2015).

[25] **Bocong Zheng** and Mingkai Lei†, Nonuniform plasma diffusion and multi-pulse effect in plasma-based ion implantation, *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 343, 83-88 (2015).

[26] **Bocong Zheng**, Kesheng Wang, and Mingkai Lei†, Modeling of inner surface modification of a cylindrical tube by plasma-based low-energy ion implantation, *Plasma Science and Technology* 17, 309-316 (2015).

[27] Yi Li, **Bocong Zheng**, and Mingkai Lei†, Plasma low-pressure nonsteady diffusion fluid model for pulsed plasma recovery, *IEEE Transactions on Plasma Science* 41, 43-48 (2013).

[28] Yi Li, **Bocong Zheng**, and Mingkai Lei†, Engineering the tube size for an inner surface modification by plasma-based ion implantation, *Vacuum* 86, 1278-1283 (2012).

Conference Abstract, Paper, and Presentation:

† as presenter or speaker

[1] **Bocong Zheng†**, Thomas Schuelke, and Qi Hua Fan, Electron heating in magnetized capacitively coupled discharges, 72st Annual Gaseous Electronics Conference, College Station, Texas, October 28-November 1, 2019. (oral)

[2] Yangyang Fu, **Bocong Zheng†**, Janez Krek, Deqi Wen, Peng Zhang, and John P. Verboncoeur, On the similarities of high pressure microdischarges, 72st Annual Gaseous Electronics Conference, College Station, Texas, October 28-November 1, 2019.

[3] **Bocong Zheng†**, Keliang Wang, Thomas Schuelke, and Qi Hua Fan, Effect of surface charge accumulation on ion current distribution in radio-frequency magnetron discharges, AVS 66th International Symposium & Exhibition, Columbus, Ohio, US, October 21-25, 2019.

[4] **Bocong Zheng†**, Thomas Schuelke, and Qi Hua Fan, Plasma modulation in a high-intensity acoustic standing wave field, 71st Annual Gaseous Electronics Conference, Portland, Oregon, November 5-9, 2018. (oral)

[5] **Bocong Zheng†**, Maheshwar Shrestha, Keliang Wang, Thomas Schuelke, and Qi Hua Fan, Modeling chemical reactions in contact glow discharge electrolysis, AVS 65th International Symposium & Exhibition, Long Beach, California, US, October 21-26, 2018. (oral)

[6] **Bocong Zheng†**, Maheshwar Shrestha, and Qi Hua Fan, Magnetically enhanced inductive plasmas generated by symmetrical solenoid coils, AVS 64th International Symposium & Exhibition, Tampa, Florida, US, October 29-November 3, 2017.

[7] Honglong Che†, **Bocong Zheng**, Di Meng, and Mingkai Lei, On the microstructure evolution of deposited Cu thin films by modulated pulsed power magnetron sputtering, The tenth session of the national assembly of surface engineering, Wuhan, China, October 28-31, 2014.

[8] **Bocong Zheng†** and Lei M K, Influence of plasma nonuniformity and recovery in plasma-based ion implantation, The 6th Joint Workshop between the School of Materials Science and

Engineering of Dalian University of Technology and Department of Metallurgy of Tokyo Institute of Technology, Dalian, China, October 25, 2014. (oral)

[9] Honglong Che†, Di Meng, **Bocong Zheng**, Fei Ye, Hui Chen, and Mingkai Lei, The effect of plasma state on microstructure of Cu films deposited by MPPMS, 2014 Sino-Russian Symposium on Advanced Materials and Processing Technology, Qingdao, China, June 3-5, 2014.

[10] **Bocong Zheng†**, Di Meng, Honglong Che, and Mingkai Lei, A time-dependent global model for modulated pulsed power magnetron sputtering discharges, 2014 Sino-Russian Symposium on Advanced Materials and Processing Technology, Qingdao, China, June 3-5, 2014. (oral)

[11] **Bocong Zheng†**, Yi Li, and Mingkai Lei, Effect of processing parameters on pulsed plasma recovery during magnetic field enhanced plasma immersion ion implantation, The 9th Asian-European International Conference on Plasma Surface Engineering, Jeju Island, Korea, August 25-30, 2013. (oral)

[12] **Bocong Zheng†**, Yi Li, and Mingkai Lei, Numerical investigation for inner surface modification of a tube by plasma-based ion implantation, 13th Joint China-Russia Symposium on Advanced Materials and Processing Technology, Harbin, China, June 5-7, 2012. (oral)

[13] Yi Li, **Bocong Zheng†**, and Mingkai Lei, Plasma recovery in plasma immersion ion implantation for a planar target modification by a fluid diffusion model, The 8th Asian-European International Conference on Plasma Surface Engineering, Dalian, China, September 19-22, 2011.

[14] Yi Li, **Bocong Zheng†,** and Mingkai Lei, The tube critical radius for an inner surface modification by plasma-based ion implantation, The 15th National Conference on Plasma Science and Technology, Huangshan, China, August 8-10, 2011. (oral)