August 2018

Shuo Huang
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Education

2014-present University of Michigan — Ann Arbor, MI
Ph.D., Electrical Engineering
Advisor: Mark J. Kushner

2011-2014 Shanghai Jiao Tong University — Shanghai, China
M.S., Electronics Science and Technology
Advisor: Jon Tomas Gudmundsson

2007-2011 Southeast University — Nanjing, China
B.E., Electrical Engineering and Its Automation

Research Projects

6/2016-present Feature scale modeling of plasma etching of high aspect ratio contacts in SiO_2
– Sponsored by Samsung Electronics

- Developed surface reaction mechanism for plasma etching of SiO_2 by $Ar/C_4F_8/O_2$ mixtures
- Investigated aspect ratio dependent etching, bowing and contact edge roughness in the etching of SiO_2 using 3-dimensional Monte Carlo Feature Profile Model (MCFPM)

12/2016-3/2018 Accelerated computation for efficient scientific simulation
– Sponsored by DARPA

- Implemented memristor-based PDE solver into the subroutine for solving the Poisson's equation in 2-dimensional Hybrid Plasma Equipment Model (HPEM)
- Evaluation of memristor-based PDE solver by modeling an inductively coupled plasma reactor using HPEM and making comparison with high-precision digital solver

8/2014-12/2017 Reactor scale modeling of selective etching of Si_3N_4 by remote plasma source
– Sponsored by Samsung Electronics

- Developed reaction mechanism of $Ar/NF_3/O_2/HBr$ and $Ar/NF_3/O_2/HCl$ for selective etching of Si_3N_4 over SiO_2
- Investigated reaction pathway and optimization of radical generation by multiple remote sources and multiple gas inlets using volume averaged global model (Global_Kin) and HPEM.

9/2011-6/2014 Reactor scale modeling of dual frequency capacitively coupled plasmas

- Developed Cl_2 reaction chemistry for 1-dimensional particle-in-cell object oriented plasma device (oopd1)
- Investigated ion energy and angular distributions and the effect of high and low frequencies on plasma properties

Refereed Journal Publications

1. **S. Huang**, V. Volynets, J. R. Hamilton, S. K. Nam, I.-C. Song, S. Lu, J. Tennyson and M. J. Kushner, Downstream etching of silicon nitride using continuous-wave and pulsed remote plasma sources sustained in $Ar/NF_3/O_2$ mixtures, *Journal of Vacuum Science and Technology A*, **36**, 021305 (2018). [Selected as Editor's Pick]
2. M. A. Zidan, Y. Jeong, J. Lee, B. Chen, **S. Huang**, M. J. Kushner and W. D. Lu, A general memristor-based partial differential equation solver, *Nature Electronics*, **1**, 411 (2018).
3. **S. Huang**, V. Volynets, J. R. Hamilton, S. Lee, I.-C. Song, S. Lu, J. Tennyson and M. J. Kushner, Insights to scaling remote plasma sources sustained in NF_3 mixtures, *Journal of Vacuum Science and Technology A*, **35**, 031302 (2017).
4. J. R. Hamilton, J. Tennyson, **S. Huang** and M. J. Kushner, Calculated cross sections for electron collisions with NF_3, NF_2 and NF with applications to remote plasma sources, *Plasma Sources Science and Technology*, **26**, 065010 (2017).
5. **S. Huang** and J. T. Gudmundsson, Dual frequency capacitively coupled chlorine discharge, *Plasma Sources Science and Technology*, **24**, 015003 (2015).
6. **S. Huang** and J. T. Gudmundsson, Ion energy and angular distributions in a dual-frequency capacitively coupled chlorine discharge, *IEEE Transactions on Plasma Science*, **42**, 2854 (2014).
7. **S. Huang** and J. T. Gudmundsson, A current driven capacitively coupled chlorine discharge, *Plasma Sources Science and Technology*, **23**, 025015 (2014).
8. **S. Huang** and J. T. Gudmundsson, A particle-in-cell/Monte Carlo simulation of a capacitively coupled chlorine discharge, *Plasma Sources Science and Technology*, **22**, 055020 (2013).

Conference Proceedings

1. **S. Huang**, J. R. Hamilton, J. Tennyson and M. J. Kushner, Remote plasma sources sustained in NF_3 mixtures, *22nd International Symposium on Plasma Chemistry*, Antwerp, Belgium, July 2015.
2. J. R. Hamilton, **S. Huang**, M. J. Kushner and J. Tennyson, Electron NF_x cross sections using UK R-matrix method for use in plasma models, *22nd International Symposium on Plasma Chemistry*, Antwerp, Belgium, July 2015.

Conference Presentations - Talks

1. **S. Huang**, M. J. Kushner, S. Shim and S. K. Nam, Optimizing uniformity in plasma etching of high aspect ratio features by engineering the focus ring, *45th IEEE International Conference on Plasma Science*, Denver, Colorado, USA, June 2018.
2. **S. Huang**, C. Huard, P. Tian, C. Qu, S. Lanham, G. Parsey, S. Mohades and M. J. Kushner, High and moderate aspect ratio etching: insights from modeling, *39th International Symposium on Dry Process*, Tokyo, Japan, November 2017.
3. C. Qu, P. Tian, **S. Huang** and M. J. Kushner, Customizing capacitively coupled plasma properties with triple-frequency power sources, *70th Gaseous Electronics Conference*, Pittsburgh, Pennsylvania, USA, November 2017.
4. K. Ford, J. Brandon, K. S. Kim, T. List, T. Ma, P. Arora, **S. Huang**, S. K. Nam, S. Shannon, V. Donnelly, M. J. Kushner, Fundamental studies of pulsed processing plasmas, *70th Gaseous Electronics Conference*, Pittsburgh, Pennsylvania, USA, November 2017.

5. **S. Huang**, V. Volynets, S. Lee, S. K. Nam and S. Lu and M. J. Kushner, Selective radical production in remote plasma sources, *64th International Symposium of the American Vacuum Society*, Tampa, Florida, USA, October 2017.
6. M. J. Kushner, C. Huard, S. Lanham, **S. Huang** and P. Tian, Translating fundamental science to technology development in plasma assisted materials processing: contributions by Harold Winters and their impact on modeling, *64th International Symposium of the American Vacuum Society*, Tampa, Florida, USA, October 2017.
7. **S. Huang**, C. Huard, M. J. Kushner, S. Shim, S-H. Lee, I-C. Song and S. Lu, Contact edge roughness in the etching of high aspect ratio contacts in SiO_2, *44th International Conference on Plasma Science*, Atlantic City, New Jersey, USA, May 2017.
8. **S. Huang**, C. Huard, S. Shim, S. Lee, I.-C. Song, S. Lu and M. J. Kushner, Plasma etching of high aspect ratio contacts in SiO_2 using $Ar/C_4F_8/O_2$ mixtures: a computational investigation, *63rd International Symposium of the American Vacuum Society*, Nashville, Tennessee, USA, November 2016.
9. P. Tian, **S. Huang**, S. Shim, S. Lee, I.-C. Song, S. Lu and M. J. Kushner, Control of uniformity and ion energy distributions in tri-frequency capacitively coupled plasmas accounting for finite wavelength effects, *63rd International Symposium of the American Vacuum Society*, Nashville, Tennessee, USA, November 2016.
10. J. R. Hamilton, **S. Huang**, M. J. Kushner, S. Rahimi, C. Hill, A. Dzarasova and J. Tennyson, Quantemol validated chemistry database: calculated cross sections for electron NF_x collisions as an example, *10th International Conference on Atomic and Molecular Data and Their Applications*, Gunsan, Republic of Korea, September 2016.
11. **S. Huang**, V. Volynets, S. Lee, I.-C. Song, S. Lu, J. R. Hamilton, J. Tennyson and M. J. Kushner, Optimizing remote plasma sources for selective etching, *43rd IEEE International Conference on Plasma Science*, Banff, Canada, June 2016.
12. **S. Huang**, V. Volynets, S. Lee, I.-C. Song, S. Lu, J. R. Hamilton, J. Tennyson and M. J. Kushner, Insights to scaling remote plasma sources sustained in NF_3 mixtures, *62nd International Symposium of the American Vacuum Society*, San Jose, California, USA, October 2015.
13. **S. Huang**, V. Volynets, S. Lee, I.-C. Song, S. Lu, J. R. Hamilton, J. Tennyson and M. J. Kushner, Dry etching of Si_3N_4 using remote plasma sources sustained in NF_3 mixtures, *68th Gaseous Electronics Conference*, Honolulu, Hawaii, USA, October 2015.
14. **S. Huang**, J. R. Hamilton, J. Tennyson and M. J. Kushner, Remote plasma sources sustained in NF_3 mixtures, *22nd International Symposium on Plasma Chemistry*, Antwerp, Belgium, July 2015.
15. **S. Huang** and J. T. Gudmundsson, Dual frequency capacitively coupled chlorine discharge, *Gordon Research Seminar on Plasma Processing Science*, Smithfield, Rhode Island, USA, July 2014.
16. J. T. Gudmundsson and **S. Huang**, A particle-in-cell/Monte Carlo simulation of a capacitively coupled chlorine discharge, *66th Gaseous Electronics Conference*, Princeton, New Jersey, USA, October 2013.

Conference Presentations - Posters

1. **S. Huang** and M. J. Kushner, Optimizing uniformity in plasma etching of high aspect ratio features by engineering the focus ring, *Gordon Research Conference on Plasma Processing Science*, Smithfield, Rhode Island, USA, August 2018.

2. **S. Huang** and M. J. Kushner, Multiple remote plasma sources for selective etching, *Gordon Research Conference on Plasma Processing Science*, Andover, New Hampshire, USA, July 2016.
3. J. R. Hamilton, **S. Huang**, M. J. Kushner and J. Tennyson, Electron NF_x cross sections using UK R-matrix method for use in plasma models, *22nd International Symposium on Plasma Chemistry*, Antwerp, Belgium, July 2015.
4. **S. Huang** and J. T. Gudmundsson, Particle-in-cell/Monte Carlo simulation of dual frequency capacitively coupled chlorine discharge, *67th Gaseous Electronics Conference*, Raleigh, North Carolina, USA, November 2014.
5. J. T. Gudmundsson and **S. Huang**, Current driven dual-frequency capacitively coupled discharge in chlorine, *The XXII Europhysics Conference on Atomic and Molecular Physics of Ionized Gases*, Greifswald, Germany, July 2014.

Theses

M.S. Thesis Particle-in-cell/Monte Carlo simulation of single and dual frequency capacitively coupled chlorine discharges, Shanghai Jiao Tong University, Shanghai, China, March 2014.
Advisor: Jon Tomas Gudmundsson
Committee: Jon Tomas Gudmundsson, Yaping Dan and Hua Bao

B.E. Thesis Particle swarm optimization applied in state estimation for IEEE 36-bus network, Southeast University, Nanjing, China, June 2011.
Advisor: Qingshan Xu