ESS6340 Advanced Plasma Engineering

We will first review the fundamental principles of plasma discharges for industrial applications such as material processing and/or plasma lightings/displays, and then discuss special topics such as plasma etch, atmospheric pressure plasmas, etc. Plasma discharge modeling using fluid model will be also introduced.

Lecture: R2R3R4, 工科館：R402

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TA: ??

Grading: Homework: 35 % (6-7 assignments)
Final Exam: 35 % 6/13 (Wed), 19:00 - 22:00
Term paper/project study report / Simulation project : 30 %

Course Outline

1. Principles of low temperature plasmas
Basic plasma equations and equilibrium (Chapter 2)
Atomic & Molecular collisions (Chapter 3 & 8)
Plasma Dynamics (Chapter 4)
Diffusion and Transport (Chapter 5)
DC Sheaths (Chapter 6)
Chemical reactions and equilibrium (Chapter 7 & 8.5)
Chemical kinetics and surface processes (Chapter 9)
Particle and energy balance in discharges (Chapter 10)
2. Plasmas sources
DC discharges (Chapter 13)
RF capacitively coupled discharges (Chapter 11)
Inductively coupled discharges (Chapter 12)
Atmospheric plasma discharges
Dielectric Barrier Discharges

Textbook:

M. Liberman and A. Lichtenberg, *Principles of Plasma Discharges and Materials Processing, 2nd ed.,* 2005.

References:

1. Alexander Fridman and Lawrence A. Kennedy, *Plasma Physics and Engineering*, 2004.
2. Yu P. Raizer, *Gas Discharge Physics*, 1997.
3. Recent journal articles from *JVSTA, Physis of Plasmas, Applied Physics Letters, PSST*, etc.
4. Brian Chapman, *Glow Discharge Processes*, 1980.
5. F.F. Chen, *Introduction to Plasma Physics and Controlled Fusion*, 1984.
6. J. R. Roth, *Industrial Plasma Engineering*, 1996.
7. Oleg A. Popov, *High Density Plasma Sources*, 1995.
8. Afred Grill, *Cold Plasma in Materials Fabrication*, 1994.
9. O. Auciello and D. Flamm, *Plasma Diagnostics*, 1989.