

# LECTURE NOTES

INTENSIVE COURSE - CLTPP-3

SOCRATES

## Course on Low Temperature Plasma Physics and Applications

Eindhoven, The Netherlands

July 8-14, 1998

Master Class on Surface and  
Volume Reactions in Molecular Plasmas

July 15-17, 1998

Support:



**Graduierntenkolleg HTPP**

**Arbeitsgemeinschaft Plasmaphysik (APP)**

**Stichting voor Fundamenteel Onderzoek der Materie (FOM)**

**Technologiestichting STW**

# PROGRAM OF THE COURSE:

## Wednesday, July 8:

- 08.15 - 08.45 Student registration  
08.45 - 09.15 Welcome and short introduction  
*M. van der Wiel*
- 09.15 - 10.45 Introduction, gas discharge, plasmas, applications, plasma types, similarities (E/N, pd), stability  
*N. St.J. Braithwaite*
- 11.15 - 12.45 Fundamentals, Debye character, collisions with neutrals, coulomb collisions, inelastic collisions, ionisation, excitation mean free paths, time constants, magnetic field confinement, Hall parameters, cyclotron resonance.  
*D.C. Schram*
- 14.00 - 15.30 Electron kinetics, processes, electron energy distributions (incl. Maxwell...), transport properties  
*J. Loureiro*
- 16.00 - 17.30 Excitation and radiation in atomic plasma, collisional radiative models,  
*J.A.M. van der Mullen.*

## Thursday, July 9:

- 09.00 - 10.30 Plasma production, plasma sources:  
DC glow, RF plasma capacitive, inductive, surfatron, helicon, ECR, microwave plasmas  
*M. Schmidt*
- 11.00 - 12.30 RF discharges, electron distribution functions, D.C. potentials, ion energy distribution, charge exchange collisions.  
*W.J. Goedheer*
- 14.00 - 15.30 RF discharges, electron kinetics, particle in cell/ Monte Carlo models  
*S. Longo*
- 16.00 - 17.30 Hydrodynamic models, numerical problems.  
*W.J. Goedheer*

## Friday, July 10:

- 09.00 - 10.30 Thermal plasmas, fundamentals, characteristic lengths, distribution functions, equilibrium, radiation etc..  
*P. Fauchais*
- 11.00 - 12.30 Thermal plasmas, generation, arcs etc., RF discharges, inductive, capacitive torch design.  
*P. Fauchais*
- 14.00 - 15.30 Application, cutting, welding etc..  
*P. Fauchais*
- 16.00 - 17.30 Radiation and spectroscopy in thermal plasmas  
*V. Helbig*

**Saturday, July 11:**

09.00 - 10.30 Kinetics in molecular plasmas, dissociation, ro-vibrational excitation, influence on charge density and distribution functions

*J. Loureiro*

11.00 - 12.30 Electron kinetics, processes in H<sub>2</sub>, N<sub>2</sub> (O<sub>2</sub>) plasmas

*A. Ricard*

**Saturday afternoon** free for shopping etc..

**Sunday, July 12:** Excursion/day off

**Monday, July 13:**

09.00 - 10.30 Surface processes, sputtering (physical and chemical), reflection, absorption, desorption polymerisation, abstraction.

*A. van Keudell*

11.00 - 12.30 Mass spectrometry. Residual gas analysis probes.

*Ch. Hollenstein*

14.00 - 15.30 Plasma diagnostics I  
interferometry, emission and absorption spectroscopy (Fourier Transform).

*Ch. Hollenstein*

16.00 - 17.30 Plasma diagnostics II  
Thomson scattering, Rayleigh scattering, CARS

*H. Kempkens*

**Tuesday, July 14:**

09.00 - 10.30 Plasma diagnostics III  
TALIF, VUV spectroscopy

*H.F. Döbele*

11.00 - 12.30 Plasma diagnostics IV  
LIF, velocity measurements, cavity ringdown

*N. Sadeghi*

14.00 - 15.30 Radical interactions, infrared spectroscopy

*G.M.W. Kroesen*

16.00 - 17.30 Ion neutral synergism during plasma etching and deposition

*M.C.M. van de Sanden*

17.30 - 18.00 Conclusions, summing up, closure.

# PROGRAM OF THE MASTER CLASS:

## Wednesday, July 15:

- 09.00 - 10.30 Modelling of (non-equilibrium) plasmas (plasma display)  
*J.P. Boeuf*
- 11.00 - 12.30 Negative ion formation, surface and volume reactions  
*W. Stoffels*
- 14.00 - 15.30 Formation of (metastable) molecules in N<sub>2</sub>/O<sub>2</sub> plasmas  
*J. Marec*
- 16.00 - 17.30 Negative hydrogen ion formation and the importance of H<sub>2</sub>(r,v)  
*B.J. Graham*
- 20.00 - 21.30 Discussion session, student contributions at the motel  
Eindhoven

## Thursday, July 16:

- 09.00 - 10.30 In-situ analysis of surface reactions  
*A. van Keudell*
- 11.00 - 12.30 Measurements of radicals and generated molecules  
*N. Sadeghi*
- 14.00 - 15.30 Modelling of plasma deposition of a-Si:H  
*W. Goedheer*
- 16.00 - 17.30 Nucleation in plasmas and powder formation  
*A. Bouchoule*

## Friday, July 17

- 08.30 - 10.00 Deposition mechanisms, a-C deposition  
*W. Jacob*
- 10.30 - 12.00 Mechanisms of a-Si:H deposition  
*M.C.M. van de Sanden*
- 12.00 - 12.45 Discussion on subjects master class and closure.
- 12.45 - 14.00 Lunch.