LANGMUIR APPLICATIONS LIST -18

Impedans PLASMA MEASUREMENT

# LANGMUIR PROBE SYSTEM

The Impedans' Langmuir Probe system is used by academia and industry globally for plasma characterisation. Below is a list of publications with their plasma sources, process gases, pressures and applications.

| Plasma Source | Density ($m^{-3}$) | Gas | Pressure(mTorr) | Published Paper |
|---|---|---|---|---|
| 2.45 GHz MW | $10^{14}$ -> $10^{17}$ | He,Ar,$O_2$,Air | 10 -> 90 | Characterization of a low-pressure microwave collisional- type coaxial plasma source used for decontamination in food industry |
| 2.45 GHz Surface Wave | $10^{11}$ -> $10^{15}$ | $N_2$ ,$N_2$,$O_2$ | 6000 | Electrical characterization of the flowing afterglow of N2 and N2/O2 microwave plasmas at reduced pressure |
| 2.45GHz ECR | $10^{14}$ -> $10^{15}$ | Air | 7.5 | Investigation of bacterial spore inactivation using a 2.45 GHz coaxial plasma source |
| ALD | $10^{15}$→$10^{16}$ | Ar | 1-1.8 sccm | Discharge characteristics and mode transition of a ring-cusp magnetically confined plasma bridge neutralizer |
| CCP | $10^{14}$ -> $10^{15}$ | Ar, C | 11.3 | Suppression of a spontaneous dust density wave by a modulation of ion streaming |
| CCP | $10^{15}$ -> $10^{16}$ | Ar | 60 -> 400 | Plasma parameters of RF capacitively coupled discharge comparative study between a plane cathode and a large hole dimensions multi-hollow cathode |
| CCP | $10^{16}$ | - | <75 | Analysis of double-probe characteristics in low-frequency gas discharges and its improvement |
| CCP | $10^{15}$ | $N_2$ | 100 -> 1000 | Capacitively coupled radio frequency nitrogen plasma generated at two different exciting frequencies of 13.56 MHz and 40 MHz analyzed using Langmuir probe along with optical emission |
| CCP | $10^{16}$ -> $10^{17}$ | Ar | 200 -> 500 | Plasma parameters in 40 MHz Argon discharge |
| CCP | $10^{15}$ -> $10^{16}$ | Ar, $N_2$ | 100 -> 1000 | Synthesis and characterization of fluorene-type and hydrogenated amorphous carbon thin films in RF and DC glow discharges |
| CCP | $10^{16}$ -> $10^{17}$ | Ar | 525 -> 862 | The Study of plasma parameters and the effect of experiment set up modification by using modelling software |
| CCP | $10^{14}$ -> $10^{15}$ | Ar,$H_2$ | 75 -> 240 | Comments on the Langmuir probe measurements of radio-frequency capacitive argon–hydrogen mixture discharge at low pressure |
| CCP | $10^{15}$ | Ar | 30 -> 500 | An investigation of the spectral lines of argon discharge with Low electron density |
| CCP | $10^{14}$-> $10^{15}$ | Ar | 50 | Experimental and numerical investigations of the phase-shift effect in capacitively coupled discharges |
| CCP | $10^{15}$ -> $10^{16}$ | $H_2$,Ar | 112.5 -> 1725 | Electrical Characteristics of Capacitive Coupled Radio Frequency Discharges in Argon and Hydrogen |
| CCP | $10^{15}$ | Ar,$H_2$ | 585 -> 825 | Optical and electrical properties of capacitive coupled radio frequency Ar-H2 mixture discharge at the low pressure |
| CCP | $10^{14}$ -> $10^{15}$ | He | 120 -> 180 | Room temperature photoluminescence in plasma treated rutile TiO2 (110) single crystals |
| CCP | $10^{16}$ -> $10^{18}$ | He | 750 | Density, temperature and magnetic field measurements in low density plasmas |
| CCP | $10^{15}$ -> $10^{16}$ | He, Ar, $O_2$ | 225 -> 375 | Evolution of plasma parameters in capacitively coupled He–O2/ Ar mixture plasma generated at low pressure using 13.56 MHz generator |
| CCP | $10^{17}$ -> $10^{18}$ | Ar | 1500 | In-Flight Size Focusing of Aerosols by a Low Temperature Plasma |

| Plasma Source | Density ($m^{-3}$) | Gas | Pressure(mTorr) | Published Paper |
|---|---|---|---|---|
| CCP | $10^{18}$ | Ga, Ar, $N_2$ | 4200 | Nonequilibrium plasma aerotaxy of size controlled GaN nanocrystals |
| CCP | $10^{14}$ -> $10^{15}$ | Ar, C | 7.5 | Observation of self-excited dust acoustic wave in dusty plasma with nanometer size dust grains |
| CCP | $10^{16}$ | He, Air | 915 | The smooth effect of fast electron detection in the positive column in DC glow discharge |
| CCP | $10^{16}$ -> $10^{17}$ | Ar | 20 | Control of ion energy distributions using phase shifting in multi-frequency capacitively coupled plasmas |
| CCP | $10^{17}$ -> $10^{18}$ | Ar | 1500 -> 10000 | Low temperature plasma as a means to transform nanoparticle atomic structure |
| CCP (Plasmalab System 100) | 0.1 -> 2 $Am^{-2}$ | Ar | 2 | Ion energy distribution measurements in rf and pulsed dc plasma discharges |
| CCP | $10^{15}$->$10^{16}$ | CO2/H2 | 1000 | Langmuir Probe, optical and mass characterisation of a DC CO2-H2 plasma |
| CCP | N/A | He | 375 | Evidence of effective local control of a plasma's nonlocal electron distribution function |
| CCP | $10^{16}$->$10^{20}$ | Ar | 1 atm | Characterisation of particle charging in low-temperature, atmospheric pressure, flow through plasmas |
| CCP | $10^{14}$-> $10^{16}$ | He/O2 | 0.04->0.08 l/min | An investigation on optical properties of capacitively coupled radio-frequency mixture plasma with Langmuir probe |
| CCP | $10^{18}$ | Ar | Atmospheric pressure | Particle charge distributions in the effluent of a flow-through atmospheric pressure low temperature plasma |
| CCP | 0->200 A m^-2 | Air | 2 sccm | Design and characterisation of a plasma chamber for improved radial and axial film uniformity |
| CCP | $10^{15}$ | Ar | 20 | The discharge characteristics of low-pressure capacitively coupled argon plasma with Langmuir probe |
| CCP | $10^{15}$ -> $10^{16}$ | Ar, Ar/O2 | 150 -> 300 | Temporal evolution of plasma parameters in a pulse-modulated capacitively coupled Ar/O2 mixture discharge |
| CCP | $10^{15}$→$10^{16}$ | Ar | 20 | The discharge characteristics of low-pressure capacitively coupled argon plasma with Langmuir probe |
| CCP | $10^{17}$ | SiH4 | 100-400 | Deposition of Very-Low-Hydrogen-Containing Silicon at a Low Temperature Using Very-High-Frequency (162 MHz) SiH4 Plasma |
| CCP | $10^{17}$ | CF4/H2 | 4 Pa | Plasma Diagnostics and Characteristics of Hydrofluorocarbon Films in Capacitively Coupled CF4/H2 Plasmas |
| CCP | $10^{16}$→$10^{17}$ | SiH4 | 100 → 400 | Deposition of Very-Low-Hydrogen-Containing Silicon at a Low Temperature Using Very-High-Frequency (162 MHz) SiH4 Plasma |
| CCP- dusty plasma | $10^{16}$ | Ar | 10^-2 mbar | Observation of non-planar dust acoustic solitary wave in a strongly coupled dusty plasma |
| CVD | $10^{16}$ -> $10^{17}$ | Ar | 525 -> 900 | The study of argon plasma based on experimental and modeling diagnosis |
| CCP/ICP | $10^{15}$ -> $10^{17}$ | Ar | 60 -> 600 | Optical emission spectroscopy and collisional-radiative modeling for low temperature Ar plasmas |
| DC Glow Discharge | $10^{16}$->$10^{17}$ | He, Air | 172-1125 | A method of electron density of positive column diagnosis—Combining machine learning and Langmuir probe |
| DC Glow Discharge | $10^{15}$ | He | 300-900 | Machine learning combined with Langmuir probe measurements for diagnosis of dusty plasma of a positive column |
| Direct Current Magnetron Sputtering | $10^{16}$ | Ar | 2→11 | Controlling the compactness and sp2 clusters to reduce interfacial damage of amorphous carbon/316L bipolar plates in PEMFCs |
| Dense plasma focus (DPF) device | $10^{17}$->$10^{23}$ | N2/O2/D2 | 525 - 3000 | Plasma processed tungsten for fusion reactor first-wall material |
| Dual CCP | $10^{12}$ -> $10^{15}$ | $N_2$ | 100 -> 1000 | Surface modification of unsized pan-based carbon fiber by using high frequency single and dual RF discharge system |
| Dual CCP | $10^{17}$->$10^{19}$ | C4F8/Ar/O2/ N2 | 30 | Plasma induced damage reduction of ultra low-k dielectric by using source pulsed plasma etching for next BEOL interconnect manufacturing |
| Dual CCP | $10^{13}$ -> $10^{15}$ | $N_2$ | 100 -> 700 | Investigation of Single and Dual RF Capacitively Coupled Nitrogen Plasma Discharges Using Optical Emission Spectroscopy |
| Dual-Hybrid HiPIMS | $10^{15}$ -> $10^{18}$ | Ar, Cu, Ti | 2.25 | Deposition of nanostructured Cu-Ti based films by advanced magnetron sputtering methods |
| Dual-Hybrid HiPIMS | $10^{17}$ -> $10^{18}$ | Ar, Cu, Ti | 3 -> 30 | Time-resolved Langmuir probe investigation of hybrid high power impulse magnetron sputtering discharges |

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| ECR | $10^{14}$ -> $10^{16}$ | Ar,Air | 3 -> 75 | 2.45 GHz ECR coaxial plasma source: characterization in single and multi-sources configuration |
| ECR | $10^{16}$ | He, Ar | 0.15 -> 0.9 | Electric Potential build-up by trapped electrons in magnetically expanding plasma |
| ECR | $10^{17}$ | N2,O2,Ar | 0.75-30 | Distributed elementary ECR microwave plasma sources supplied by solid state generators for production of large area plasmas without |
| ECR + RF | $10^{16}$ →$10^{17}$ | He | 0.5 → 0.75 | Comparative analysis of the plasma parameters of ECR and combined ECR + RF discharges in the TOMAS plasma facility |
| Fusion-relevant RF ion source | $10^{16}$ → $10^{17}$ | H2 | 0.45-0.7 Pa | A method to measure the electric parameters of the driver in a fusion-relevant RF ion source |
| Glow Discharge | $10^{16}$ -> $10^{17}$ | He | 112.5 -> 562.5 | Properties of a large volume glow discharge helium plasma by measuring the broadband microwave phase shift in different pressures |
| Hall Thruster | $10^{15}$ -> $10^{18}$ | Xe | 13.5 -> 45 | Anode geometry influence on LaB6 cathode discharge characteristics |
| Hall Thruster | $10^{15}$ -> $10^{16}$ | Ar | 30 | Measurement of plasma parameters in the far-field plume of a Hall effect thruster |
| Hall Thruster | $10^{16}$ -> $10^{17}$ | Xe | 0.0015 | Electron flow properties in the far-field plume of a Hall thruster |
| Hall Thruster | $10^{15}$ -> $10^{16}$ | Xe, Kr | 0.0225 | Time-resolved measurement of plasma parameters in the far- field plume of a low-power Hall effect thruster |
| Hall Thruster | $10^{16}$ | Xe | 0.015 | The time-varying electron energy distribution function in the plume of a Hall thruster |
| Hall Thruster | $10^{16}$ -> $10^{18}$ | Xe | 0.015 | Electron energy distribution function in a low-power Hall thruster discharge and near-field plume |
| Hall Thruster | $10^{14}$ → $10^{16}$ | Xenon | 0.007 | Spatial evolution characteristics of ion and electron flow for 300 W class low-power Hall thruster |
| Hencken Burner | $10^{18}$->$10^{19}$ | Ar, CH4 | 19.9-39.8 slpm | Combustion plasma electrical conductivity model validation for oxy-fuel MHD applications: Spectroscopic and electrostatic probe studies |
| Hot filament Evaporator | $10^{18}$ | Ar | 6000 | Phase mixing in GaSb nanocrystals synthesized by nonequilibrium plasma aerotaxy |
| Helicon | $10^{16}$ -> $10^{17}$ | Ar | 2.6 | Two density peaks in low magnetic field helicon plasma |
| Helicon | $10^{15}$ -> $10^{16}$ | Ar | 2.62 | Modulation of absorption manner in helicon discharges by changing profile of low axial magnetic field* |
| Helicon | $10^{16}$ -> $10^{18}$ | Ar | 2.25 | The Evolution of Discharge Mode Transition in Helicon Plasma Through ICCD Images |
| Helicon | | Kr and Xe | 4->10 | Direct experimental comparison of krypton and xenon discharge properties in the magnetic nozzle of a helicon plasma source |
| Helicon | | | | Comparative Study on Experimental Data of Plasma Plumes in Space |
| Helicon | $10^{17}$ (Data Acq. Unit) | Kr, Xe | 0.75 | Direct experimental comparison of krypton and xenon discharge properties in the magnetic nozzle of a helicon plasma source |
| Helicon | $10^{17}$ (Data Acq. Unit) | Kr, Xe | 0.75 | Electron and Ion Properties in the Beam and Discharge of a Helicon Plasma Source for Application in Spacecraft Propulsion |
| Helicon | $10^{19}$ | Ar | 2.25 | Influence of neutral depletion on blue core in argon helicon plasma |
| Helicon | $10^{15}$ → $10^{17}$ | Kr | 3.75 | Plasma properties conditioned by the magnetic throat location in a helicon plasma device |
| Helicon | $10^{17}$ | Ar | 0.75 → 7.5 | Striations in helicon-type argon plasma |
| Helicon | $10^{17}$ → $10^{18}$ | Ar | 2.7 | Effect of inhomogeneous magnetic field on blue core in Ar helicon plasma |
| Helicon | $10^{17}$ | Xe | 0.001 mbar | Electron thermodynamics along magnetic nozzle lines in a helicon plasma |
| Helicon plasma | $10^{18}$ | Ar | 0.08 Pa to 0.68 Pa | Effect of neutral pressure on the blue core in Ar helicon plasma under an inhomogeneous magnetic field |
| Helicon plasma | $10^{16}$ | Ar and O2 | 100 | Characterization of elastomer degradation in O2/Ar plasma via mass and surface morphology changes |
| Helicon plasma | $10^{18}$ | Ar | 0.1 Pa to 1 Pa | The wave mode transition of argon helicon plasma |
| HiPIMS | $10^{20}$ | He | 6Pa | A study of the formation of fuzzy tungsten in a HiPIMS plasma system |

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| HiPIMS | $10^{16}$ -> $10^{17}$ | Ar, Cr | 0.5 -> 20 | Spectroscopic investigation on the near-substrate plasma characteristics of chromium HiPIMS in low density discharge mode |
| HiPIMS | $10^{13}$ -> $10^{17}$ | Ar, $O_2$, Ti | 6.98 | The behaviour of negative oxygen ions in the afterglow of a reactive HiPIMS discharge |
| HiPIMS | $10^{16}$ -> $10^{18}$ | Ar, $O_2$, Ti | 5.63 | Design of magnetic field configuration for controlled discharge properties in highly ionized plasma |
| HiPIMS | $10^{15}$ -> $10^{16}$ | Ar,$O_2$,Al | 1.5 | Investigating the plasma parameters and discharge asymmetry in dual magnetron reactive high power impulse magnetron sputtering discharge with Al in Ar/O2 mixture |
| HiPIMS | $10^{16}$ -> $10^{17}$ | Ar,$O_2$,Ti | 7.5 | Angular dependence of plasma parameters and film properties during high power impulse magnetron sputtering for deposition of Ti and TiO2 layers |
| HiPIMS | $10^{16}$ -> $10^{18}$ | Ar,$O_2$,Ti | 5.63 | Enhanced oxidation of TiO2 films prepared by high power impulse magnetron sputtering running in metallic mode |
| HiPIMS - ECWR | < $10^{18}$ | Ar, $O_2$, Ti | 0.6 -> 75 | Deposition of rutile (TiO2) with preferred orientation by assisted high power impulse magnetron sputtering |
| HiPIMS - ECWR | $10^{16}$ -> $10^{18}$ | Ar, Ti | 0.375 | Plasma diagnostics of low pressure high power impulse magnetron sputtering assisted by electron cyclotron wave resonance plasma |
| HiPIMS (PLATTIT π) | $10^{16}$ -> $10^{17}$ | Ar, Ti | 4.9 | Microstructure-driven strengthening of TiB2 coatings deposited by pulsed magnetron sputtering |
| HiPIMS | $10^{16}$ → $10^{17}$ | Ar/N2 | 0.6 Pa | Microwave plasma-assisted reactive HiPIMS of InN films: Plasma environment and material characterisation |
| HIPIMS | $10^{14}$→$10^{15}$ | Ar | 60-100 sccm | From pulsed-DCMS and HiPIMS to microwave plasma-assisted sputtering: Their influence on the properties of diamond-like carbon films |
| HiPMS-Dual magnetron reactive | $10^{17}$ | Ar/02 | 3 | Influence of magnetic field configuration on plasma characteristics and thin film properties in dual magnetron reactive high power impulse magnetron sputtering discharge with Al in Ar/O2 mixture |
| HiPIMS and Microwave | $10^{16}$ | Ar | 3 → 4.5 | From pulsed-DCMS and HiPIMS to microwave plasma-assisted sputtering: Their influence on the properties of diamond-like carbon films |
| HiPIMS | | Ar/N2 | 0.2-0.6 Pa | NanostructureandOpticalPropertyTailoringofZincTinNitride ThinFilmsthroughPhenomenologicalDecoupling:APathwayto EnhancedControl |
| High-voltage AC | $10^{17}$ | Air | Atmospheric pressure | A novel atmospheric-pressure air plasma jet for wound healing |
| Hot Cathode Plasma | $10^{13}$ | Ar | 0.8 | Matched dipole probe for magnetized low electron density laboratory plasma diagnostics |
| Hot Cathode Plasma | $10^{12}$ -> $10^{13}$ | Ar | 0.15 | Ion and electron sheath characteristics in a low density and low temperature plasma |
| Hollow Cathode | $10^{15}$ -> $10^{18}$ | $O_2$ | 450 -> 825 | Characterization and application of hollow cathode oxygen plasma |
| Hollow Cathode | $10^{16}$ | Ar, Air | 375 -> 750 | Probe Diagnostics of Plasma Parameters in a Large-Volume Glow Discharge With Coaxial Gridded Hollow Electrodes |
| Hollow Cathode | $10^{15}$ -> $10^{16}$ | Ar | 187.5 | Numerical and Experimental Diagnostics of Dusty Plasma in a Coaxial Gridded Hollow Cathode Discharge |
| Hollow Cathode | $10^{16}$ | Ar | 187.5 | Investigation of Low-Pressure Glow Discharge in a Coaxial Gridded Hollow Cathode |
| Hollow Cathode | $10^{16}$ | He | 112.5 | Diagnostics of large volume coaxial gridded hollow cathode DC discharge |
| Hollow Cathode | $10^{16}$ -> $10^{17}$ | He | 112.5 -> 562.5 | Broadband microwave propagation in a novel large coaxial gridded hollow cathode helium plasma |
| Hollow Cathode | $10^{15}$ -> $10^{16}$ | $O_2$ | 450 -> 787.5 | Micro-grooving into thick CVD diamond films via hollow- cathode oxygen plasma etching |
| Hollow Cathode | $10^{16}$ | Ar | 112.5 -> 412.5 | Broadband microwave characteristics of a novel coaxial gridded hollow cathode argon plasma |
| Hollow Cathode | $10^{16}$ | Ar | 150 | Absolute continuum intensity diagnostics of a novel large coaxial gridded hollow cathode argon plasma |

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|---|---|---|---|---|
| Hot Cathode Magnetic Filter | $10^{11}$ -> $10^{12}$ | Ar, $SF_6$ | 0.165 | Sheath characteristics in a magnetically filtered low density low temperature multicomponent plasma with negative ions |
| Hot Cathode Plasma | $10^{13}$ | Ar | 0.8 | Matched dipole probe for magnetized low electron density laboratory plasma diagnostics |
| Hot Cathode Plasma | $10^{12}$ -> $10^{13}$ | Ar | 0.15 | Ion and electron sheath characteristics in a low density and low temperature plasma |
| Hybrid – Dual- HiPIMS | $10^{17}$ -> $10^{18}$ | Ar, Ti, Cu | 3 -> 30 | Time-resolved Langmuir probe investigation of hybrid high power impulse magnetron sputtering discharges |
| ICP | $10^{16}$ -> $10^{17}$ | Ar, $O_2$ | 10 -> 50 | Experimental and numerical investigations on time-resolved characteristics of pulsed inductively coupled $O_2$/Ar plasmas |
| ICP | $10^{17}$ | H | 3.75 -> 22.5 | Investigation of the power transfer efficiency in a radio- frequency driven negative hydrogen ion source |
| ICP | $10^{15}$-> $10^{17}$ | H, Ar | 2 -> 150 | Investigation of a Magnetically Enhanced Inductively Coupled Negative Ion Plasma Source |
| ICP | $10^{17}$ -> $10^{18}$ | Ar | 3.75 -> 75 | Nonlocal electron kinetics and spatial transport in radio- frequency two-chamber inductively coupled plasmas with argon discharges |
| ICP | $10^{16}$ -> $10^{17}$ | Ar | 10 -> 50 | A hybrid model of radio frequency biased inductively coupled plasma discharges: description of model and experimental validation in argon |
| ICP | $10^{17}$ | H | 2.25 | Development of RF Driver Used in Negative Ion Source at HUST |
| ICP | $10^{16}$ | H | 45 | Study on the RF Power Necessary to Ignite Plasma for the ICP Test Facility at HUST |
| ICP | $10^{15}$ | Ar | 2 -> 10 | Comparison of plasma parameters determined with a Langmuir probe and with a retarding field energy analyzer |
| ICP | $10^{16}$ -> $10^{17}$ | $H_2$ | 2.25 -> 22.5 | A global model study of the population dynamics of molecular hydrogen and the generation of negative hydrogen ions in low-pressure ICP discharge with an expansion region: effects of EEPF |
| ICP | $10^{15}$ | Ar, $H_2$ | 40 | Absolute density measurement of hydrogen atom in inductively coupled Ar/H2 plasmas using vacuum ultraviolet absorption spectroscopy |
| ICP | $10^{16}$ -> $10^{17}$ | He | 0.5 -> 2 | Spatial distributions of plasma parameters in inductively coupled hydrogen discharges with an expansion region |
| ICP | $10^{16}$ -> $10^{17}$ | $H_2$ | 0.75 -> 37.5 | Experimental and numerical investigations of electron |
| ICP | N/a | $CO_2$, Ar, $N_2$ | 37.5 -> 1312 | Tuning of Conversion and Optical Emission by Electron Temperature in Inductively Coupled CO2 Plasma |
| ICP | $10^{16}$-> $10^{17}$ | $N_2$ | 2.25 | The discharge characteristics in nitrogen helicon plasma |
| ICP | $10^{17}$ | CO2, CO, O2, Ar | 750 | Superlocal chemical reaction equilibrium in low temperature plasma |
| ICP | $10^{17}$ | C5F8,C5F8/Ar | 5->15 | Study on plasma characteristics and gas analysis before and after recovery using liquid-fluorocarbon precursor |
| ICP | $10^{16}$ | H2 | 40 | Numerical investigation of ion energy and angular distributions in a dc-biased H2 inductively coupled discharge |
| ICP | | Ar | 20 | Experimental Study of SiO2 Sputter Etching Process in 13.56 MHz rf-Biased Inductively Coupled Plasma |
| ICP | $10^{15}$->$10^{16}$ | Ar/03 | 22.5 - 82.5 | Measurement of electronegativity during the E to H mode transition in a radio frequency inductively coupled Ar/O2 plasma |
| ICP | $10^{14}$->$10^{16}$ | He | 200-800 | Optical emission spectroscopy and collisional-radiative modeling for non-equilibrium, low temperature helium plasma |
| ICP | $10^{15}$-$10^{16}$ | H2 | 5, 10 | Predictive estimation of vacuum ultraviolet emission intensity in a low-pressure inductively coupled hydrogen plasma based on the branching ratio technique |
| ICP | $10^{16}$ | N2 | 10-30 | Comprehensive Data Collection Device for Plasma Equipment Intelligence Studies |
| ICP | $10^{17}$ | CH4 | 3-12 | Radical flux control in reactive ion beam etching (RIBE) by dual exhaust system |
| ICP | $10^{15}$-$10^{16}$ | Ar | 75-450 | Study on the modified effect of polyvinylidene fluoride membrane by remote argon plasma |

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| ICP | $10^{17}$ | H2 | 12-30 | Two-dimensional spatial distribution and production mechanism of H− ions in cylinndrical Inductively Coupled H2 plasma |
| ICP | $10^{17}$-$10^{18}$ | Ar | 0.75- 7.5 | Hybrid model of radio-frequency low-pressure inductively coupled plasma discharge with self-consistent electron energy distribution and 2D electric field distribution |
| ICP | $10^{14}$ | Ar | 75→450 | Study on the modified effect of polyvinylidene fluoride membrane by remote argon plasma |
| ICP | $10^{17}$→$10^{18}$ | Ar+O2 | 0.2- 7 Pa | Measurement of neutral gas temperature in inductively coupled Ar and Ar/O2 plasmas |
| ICP | $10^{17}$ | CH4 | 3.3-3.5 | Radical flux control in reactive ion beam etching (RIBE) by dual exhaust system |
| ICP | $10^{16}$→$10^{17}$ | Ar+O2 | 0.3-11 Pa | Power transfer efficiency and the power threshold for E–H mode transition in inductively coupled plasmas |
| ICP | $10^{16}$ | Ar | 50-60 | Optimization of overshoot in the pulsed radio frequency inductively coupled argon plasma by step waveform modulation |
| ICP | $10^{16}$ | Ar/N2 | 1.33 Pa | The effect of gas composition on the properties of silicon oxynitride thin film prepared by low-pressure inductively coupled Ar/N2 plasma |
| ICP, ALD | | O2 | 750 | Two-regime property dependence on plasma power of plasma-enhanced atomic layer-deposited In2O3 thin films and underlying mechanism |
| ICP/Reactiv Ion beam etching system | $10^{15}$ | H2/NH3 | 1 | Study on etch characteristics of magnetic tunnel junction materials using rf-biased H2/NH3 reactive ion beam |
| ICP, PECVD | $10^{17}$ | C2H2 and H2 | 6 & 2 sccm | Position-Induced Controllable Growth of Vertically Oriented Graphene Using Plasma-Enhanced Chemical Vapor Deposition |
| Laser Plasma hybrid welding system | $10^{19}$ → $10^{20}$ | Ar | 1 E6 Pa | Plasma characteristics of a novel coaxial laser-plasma hybrid welding of Ti alloy |
| Magnetic Mirror | $10^{16}$-> $10^{17}$ | $N_2$ | 0.2 -> 4 | Signatures of ring currents in a magnetic mirror plasma experiment |
| Magnetron | $10^{16}$-> $10^{17}$ | Ar, Cu | 0.75 -> 37.5 | The erosion groove effects on RF planar magnetron sputtering |
| Magnetron | 2 -> 70 $Am^{-2}$ | Ar, $N_2$, Al | 3.75 | Tunable ion flux density and its impact on AlN thin films deposited in a confocal DC magnetron sputtering system |
| Magnetron | $10^{16}$-> $10^{17}$ | Ar, Ne Kr, Xe | 5 | Measurements of sputtered neutrals and ions and investigation of their roles on the plasma properties during rf magnetron sputtering of Zn and ZnO targets |
| Magnetron | $10^{16}$->$10^{17}$ | Ar | 3000 | Structural and plasma characterisation of the power effect on the chromium thin film deposited by DC magnetron sputtering |
| Magnetron sputtering | $10^{16}$→$10^{17}$ | Ar | 2 | Controlling the compactness and sp2 clusters to reduce interfacial damage of amorphous carbon/ 316L bipolar plates in PEMFCs |
| MAGPIE | $10^{17}$ -> $10^{19}$ | Ar, $H_2$ | 3.1 | Design and characterization of the Magnetized Plasma Interaction Experiment (MAGPIE): a new source for plasma– material interaction studies |
| MAGPIE | $10^{16}$ | $H_2$, $N_2$ | 10 | A volume-averaged model of nitrogen–hydrogen plasma chemistry to investigate ammonia production in a plasma- surface-interaction device |
| MAGPIE | $10^{18}$ | Ar | 3 | Wave modeling in a cylindrical non-uniform helicon discharge |
| MAGPIE | $10^{16}$ -> $10^{17}$ | Ar | 1.4 -> 3 | Plasma parameters and electron energy distribution functions in a magnetically focused plasma. |
| MAGPIE | $10^{16}$ -> $10^{17}$ | H | 5 -> 10 | Negative hydrogen ion production in a helicon plasma source |
| MAGPIE | < $10^{19}$ | H | 10 | Ion flux dependence of atomic hydrogen loss probabilities on tungsten and carbon surfaces |
| Magnetically confined hot hollow cathode PE-CVD | $10^{15}$ | Ar/Ne | 5 → 50 | Fabricating Diamond-like Amorphous Carbon |
| Microhollow cathode discharges | $10^{20}$ | He | Atmospheric pressur | Diagnostics and comparative analyzes of plasma parameters in micro hollow cathode discharges with an open and covered external surface of cathode in helium using an additional electrode |

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|---|---|---|---|---|
| MW | $10^{14}$ | Ar | 150 -> 200 | Apparatus for generating quasi-free-space microwave-driven plasmas |
| MW | $10^{15}$ -> $10^{16}$ | He | 525 | Microwave technology used for plasma diagnostic in complicated situations |
| MW | $10^{16}$ -> $10^{17}$ | Ar, $O_2$ | 75 -> 225 | Heating power at the substrate, electron temperature, and electron density in 2.45 GHz low-pressure microwave plasma |
| MW | $10^{17}$ -> $10^{18}$ | He, Ar | 1000 -> 10000 | A prospective microwave plasma source for in situ spaceflight applications |
| NExET | $10^{17}$ -> $10^{18}$ | Xe | 0.8 mg s^-1 | Electron properties of an emissive cathode: Analysis with incoherent thomson scattering, fluid simulations and Langmuir probe measurements |
| NExET | $10^{18}$ | Xe | 15 | Anode position influence on discharge modes of a LaB6 cathode in diode configuration |
| NExET | $10^{15}$ -> $10^{18}$ | Xe | 13.5 -> 45 | Anode geometry influence on LaB6 cathode discharge characteristics |
| PEGASES Thruster | $10^{15}$ -> $10^{17}$ | Ar, Xe | 0.75 | Investigation of Magnetized radio frequency plasma courses for electric space propulsion |
| PEGASES Thruster | $10^{18}$ | $SF_6$, Ar, Xe, He, $O_2$, $N_2$ | 0.75 | Plasma drift in a low-pressure magnetized radio frequency discharge |
| PPS 1350-ML Hall Thruster | $10^{16}$ -> $10^{17}$ | Xe | 0.0015 | Electron flow properties in the far-field plume of a Hall thruster |
| PPS100-ML Hall Thruster | $10^{15}$ -> $10^{16}$ | Xe | 2.92 -> 4.5 mg $s^{-1}$ | Measurement of plasma parameters in the far-field plume of a Hall effect thruster |
| Proton Linear Accelerator | $10^{18}$ -> $10^{19}$ | H | 1.125 -> 5 | Plasma characterization of the superconducting proton linear accelerator plasma generator using a 2 MHz compensated Langmuir probe |
| Pulsed ICP | $10^{15}$ -> $10^{16}$ | $CH_4$,$O_2$,Ar | 0.975 | Nanometer-scale etching of CoFeB thin films using pulse- modulated high density plasma |
| Pulsed ICP | $10^{16}$ -> $10^{17}$ | Ar, $CF_4$ | 1 -> 80 | Complex transients of input power and electron density in pulsed inductively coupled discharges |
| Pulsed ICP | $10^{14}$->$10^{16}$ | O2/Ar | 10 | Time-resolved radial uniformity of pulse-modulated inductively coupled O2/Ar plasmas |
| Pulsed ICP | $10^{16}$ | Ar/CH4 | 1 → 80 | Spatio-temporal measurements of overshoot phenomenon in pulsed inductively coupled discharge |
| Pulsed DC | $10^{16}$ | Ar | 6Pa | Modeling and experimental comparison of pulsed-DC driven low-pressure plasma discharge in a metal tube |
| Pulsed Laser Deposition | $10^{16}$ | $O_2$, $WO_3$ | 7.5 | Optimization of substrate-target distance for pulsed laser deposition of tungsten oxide thin films using Langmuir probe |
| Pulsed magnetic field system | $10^{15}$-$10^{16}$ | Air | 3.75-37 | Density reduction on plasma sheath using pulsed magnetic field |
| Pulsed Laser Deposition | $10^{16}$ -> $10^{17}$ | $O_2$, $CeO_2$ | 7.5 | Plasma plume behavior of laser ablated cerium oxide: Effect of oxygen partial pressure |
| PULVA reactor | $10^{15}$ | Ar, $C_2H_2$ | 15 -> 30 | Metastable argon atom density in complex argon/acetylene plasmas determined by means of optical absorption and emission spectroscopy |
| Ring-cusp magnetically confined plasma bridge neutralizer. | | | | The upgraded TOMAS device: A toroidal plasma facility for wall conditioning, plasma production, and plasma–surface interaction studies |
| Specially designed multi arm structure (RF) | $10^{16}$ ->$10^{17}$ | N2 | 300 | Low temperature silicon nitride grown by very high frequency (VHF, 162MHz) plasma enhanced atomic layer deposition with floating multi-tile electrode |
| TOMAS Device | $10^{15}$ -> $10^{16}$ | He, H2 | 0.3 - 7.5 | The upgraded TOMAS device: A toroidal plasma facility for wall conditioning, plasma production, and plasma–surface interaction studies |
| Toroidal Magnetized System | $10^{16}$ -> $10^{17}$ | $N_2$ | 5 -> 25 | Nitriding process for next-generation semiconductor devices by VHF (162 MHz) multi-tile push-pull plasma source |

| | | | | |
|---|---|---|---|---|
| The Toroidal MAgnetized System (TOMAS) plasma facility | $10^{16}$ -> $10^{17}$ | $H_2$ | 4.5 × 10−2 Pa | Overview of TOMAS plasma diagnostics |
| VHF Multi-tile Push-Pull | $10^{16}$ | Ar | 0.01-0.06 l/min | Investigation of branching fraction in the mechanically forced discharge region using optical emission spectrum |

*Click here to read more about Plato Probe System.

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# PLATO PROBE SYSTEM

The Plato Probe is a planar Langmuir Probe designed to work in deposition plasmas when an insulating film will be deposited on the probe surface. This allows the plasma parameters such as plasma density, Ion current density and electron temperature to be measured in systems where a standard Langmuir probe would not be suitable, such as plasma enhanced chemical vapour deposition (PECVD) systems.

| Plasma Source | Electron Temperature (eV) | Gases | Pressure | Published Paper |
|---|---|---|---|---|
| Ion Beam Assisted-CVD | 2-4.5 | Ar | 0.24 - 1 | Ion beam assisted chemical vapor deposition of hybrid coatings—Process diagnostics and mechanisms |

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