INPTDAT – a new data platform for plasma technology

Markus M. Becker[1,*], Lucian Paulet[1], Steffen Franke[1], Deborah O'Connell[2]

[1]Leibniz Institute for Plasma Science and Technology (INP), Felix-Hausdorff-Straße 2, 17489 Greifswald, Germany

[2]York Plasma Institute, Department of Physics, University of York, Heslington, York, YO10 5DD, U.K.

*Email: markus.becker@inp-greifswald.de

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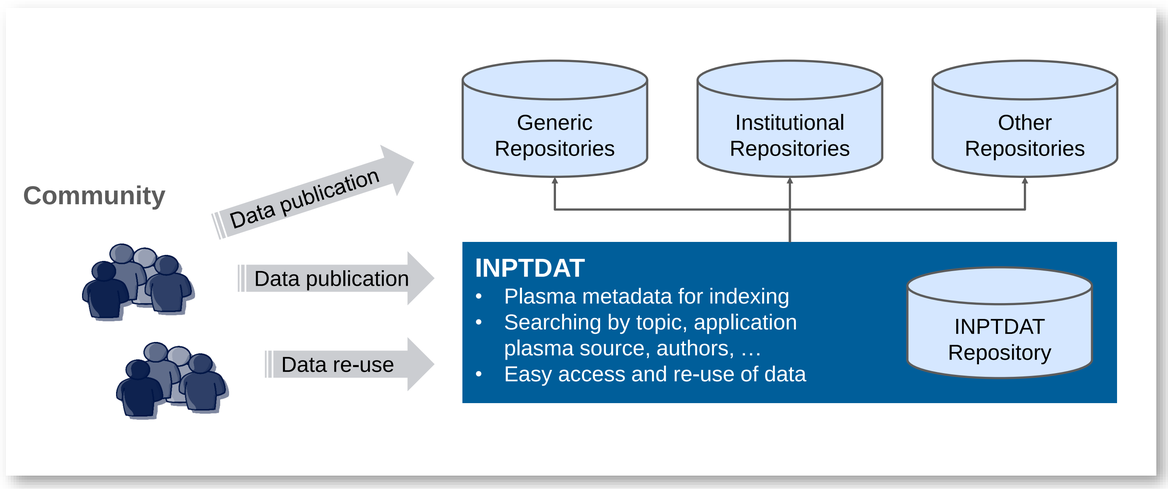
INTRODUCTION

- In recent years, the need for public storage of digital research data has steadily increased (policies of funders, publishers, and institutions, transparency of research).
- Besides institutional or public repositories, like figshare and zenodo, more and more publishers provide the possibility to store digital data along with journal articles.
- The findability of data in generic repositories is rather limited and the benefit of publishing digital research data is often not obvious to researchers.
- The new interdisciplinary data platform for plasma technology—INPTDAT aims at supporting data driven plasma science and the publication of digital research data in accordance with the FAIR data principles [1,2].



METADATA SCHEMA PLASMA-MDS

- Subject-specific metadata schema for annotation of research data in low-temperature plasma physics and plasma medicine [3]
- Extension to basic schemas (e.g. Dublin Core, DataCite)
- Metadata fields for description of
  - » plasma source
  - » plasma medium
  - » plasma target
  - » diagnostics / modelling / simulations
  - » resources (data)
- To be reviewed after initial phase of growing usage
- Community standard as a long-term perspective

plasma.source	
1.1	name
1.2	application
1.3	specification
1.4	properties
1.5	procedure

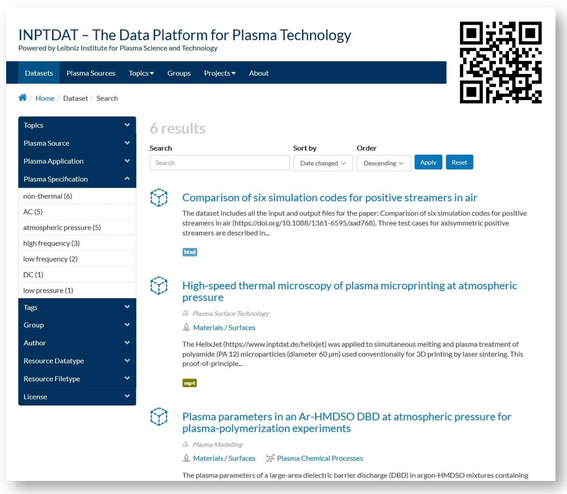
plasma.medium	
1.1	name
2.2	properties
2.3	procedure

plasma.target	
3.1	name
3.2	properties
3.3	procedure

plasma.diagnostics	
4.1	name
4.2	properties

plasma.resource	
5.1	filetype
5.2	datatype
5.3	range
5.4	quality

FEATURES OF INPTDAT DATA PLATFORM



- INPTDAT is a Drupal (dkan) based data platform for plasma technology and plasma medicine featuring
  - » data publications with DOI
  - » plasma source catalog
  - » faceted search
  - » online visualization
  - » API based access to (meta)data
- Prototype for community platform
- Further development in frame of QPTDat
  - » https://www.inptdat.de/project-qptdat

INPTDAT (https://www.inptdat.de)

Sharing and re-use of research data in the field of plasma technology | Domain specific metadata | DataCite compatibility | DOI integration

dkan (https://getdkan.org)

Open Data Platform | Datastore API | Harvesting | Open Data Schema Mapper | Visualizations | Workflows

Drupal (https://www.drupal.org)

Content management | General framework | Interface | Roles and permissions | Static content | User management

EXAMPLE OF LOCAL RESOURCE

- Metadata and data published with INPTDAT

Benchmark data for fluid modelling of low-pressure CCRF discharge plasmas

Plasma Chemical Processes

The dataset contains data from comparative studies of capacitively coupled radio-frequency (CCRF) discharges in helium and argon at pressures between 10 and 80 Pa applying two different fluid modeling approaches as well as two independently developed particle-in-cell Monte Carlo collision (PIC-MCC) codes. The dataset provides a test bed for future studies of simple ccrf discharge configurations in helium and argon at pressures ranging from 10 to 80 Pa.

plasma modelling/simulation · benchmark data

Field	Value
Group	Plasma Modelling
Authors	Becker, Markus M. Kählert, Hanno Sun, Anbang Loffhagen, Detlef
Release Date	2019-06-14
Resources	Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 20 Pa) Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 40 Pa) Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 80 Pa) Benchmark data for CCRF discharge plasmas - time averaged ion density (helium, 10 Pa) Benchmark data for CCRF discharge plasmas - time averaged ion density (helium, 20 Pa) Show more
Identifier	60dbcdd4-8be4-4f41-896c-e725bdb37fe2
Permanent Identifier (DOI)	doi:10.34711/inptdat.72
Permanent Identifier (URI)	https://www.inptdat.de/node/72
Is supplementing	M. M. Becker et al., Plasma Sources Sci. Technol. 26 (2017) 044001
Plasma Source Name	CCP
Plasma Source Specification	AC high frequency low pressure non-thermal
Plasma Source Properties	Low-pressure RF plasma between plane electrodes separated by the distance d, driven by a sinusoidal voltage with amplitude V0 and frequency f; d = 2.5 cm (argon) resp. 6.7 cm (helium); V0 = 50-250 V; f = 13.56 MHz; Current density: 10 A/m^2
Plasma Medium Name	He Ar
Plasma Medium Properties	Gas temperature: 300 K; Pressure: 10-80 Pa
Plasma Diagnostics Name	fluid-Poisson model pic-mcc simulation
Plasma Diagnostics Properties	The fluid description of the electron component is performed by means of two different drift-diffusion approaches: the novel drift-diffusion model DDAn introduced in Becker and Loffhagen 2013 (https://doi.org/10.1063/1.4775771) and the commonly used classical drift-diffusion model DDA53 using simplified electron energy transport coefficients. Details of both fluid modelling

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License	Creative Commons Attribution 4.0 International (CC BY 4.0)
Public Access Level	Public
Contact Name	Becker, Markus M.
Contact Email	markus.becker@inp-greifswald.de

Data and Resources

Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 20 Pa) — Preview · Download
This data table includes the time-averaged ion density profiles between the...

Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 40 Pa) — Preview · Download
This data table includes the time-averaged ion density profiles between the...

Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 20 Pa)

This data table includes the time-averaged ion density profiles between the electrodes as obtained from the two different PIC-MCC simulation codes (PIC-ITAP and PIC-INP), and the two different fluid models (DDAn and DDA53) in argon at a gas pressure of 20 Pa.

node72_data-table_Ni_Ar20Pa.csv

Data Preview: Note that by default the preview only displays up to 100 records. Use the pager to flip through more records or adjust the start and end fields to display the number of records you wish to see.

Grid · Graph · 101 records · « 1 – 100 » · Search data ... · Go » · Filters · Fields

z/d [1]	Ion density (PIC...	Ion density (PIC...	Ion density (Flui...	Ion density (Flui...
2.20000...	1.0737020e+00	1.1138670e+00	6.3982715e-01	7.3124989e-01
7.80000...	1.0762716e+00	1.1114027e+00	6.3982715e-01	7.3124989e-01
2.30000...	1.1525440e+00	1.1956534e+00	6.8971011e-01	7.6071810e-01
7.70000...	1.1548073e+00	1.1938724e+00	6.8971011e-01	7.6071810e-01
2.40000...	1.2254357e+00	1.2640743e+00	7.3971912e-01	7.8843360e-01
7.60000...	1.2273838e+00	1.2613721e+00	7.3971912e-01	7.8843360e-01
2.50000...	1.2914094e+00	1.3313631e+00	7.8947558e-01	8.1422289e-01
7.50000...	1.2956410e+00	1.3352501e+00	7.8947558e-01	8.1422289e-01

Resources

- Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 20 Pa)
- Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 40 Pa)
- Benchmark data for CCRF discharge plasmas - time averaged ion density (argon, 80 Pa)
- Benchmark data for CCRF discharge plasmas - time averaged ion density (helium, 10 Pa)
- Benchmark data for CCRF discharge plasmas - time averaged ion density (helium, 20 Pa)
- Benchmark data for CCRF discharge plasmas - time averaged ion density (helium, 40 Pa)

Additional Information

Field	Value
mimetype	text/csv
filesize	7.07 KB
resource type	file upload
timestamp	Jun 28, 2019

Resource filetype	csv
Resource datatype	data table
Resource range	Gas: argon at 20 Pa
Resource quality	verified

EXAMPLE OF EXTERNAL RESOURCE

- Metadata published with INPTDAT, link to external data resources

Non-thermal plasma in contact with water: The origin of species

Plasma Chemical Processes · Plasma Medicine

The dataset is the raw data (presented in numerical format) from the EPR, 1H NMR and HR-MS experiments. The respective Excel files describe the experiments to which the dataset belongs. Please refer to the original publication and ESI for more information.

EPR spectroscopy · isotopic labelling · plasma chemistry · radicals · reactive oxygen species

Field	Value
Authors	Gorbanev, Yury Chechik, Victor O'Connell, Deborah
Release Date	2015-12-07
Resources	Non-thermal plasma in contact with water: The origin of species (external resource)
Identifier	aa998c4a-ccbe-4563-a96c-dc3169bace53
Permanent Identifier (DOI)	doi:10.15124/15f674be-e9ca-4a00-9ba6-3c24e70a6aa4
Is supplementing	Y. Gorbanev et al., Chemistry : A European Journal 22 (2016) 3496-3505
Plasma Source Name	kHz plasma jet CAP
Plasma Source Application	reactive species generation
Plasma Source Specification	AC low frequency atmospheric pressure non-thermal
Plasma Source Properties	The plasma was ignited in a quartz tube (4 mm ID and 6 mm OD, 100 mm length) surrounded by copper electrodes (10 mm width) separated by 20 mm. A PVM500 Plasma Resonant and Dielectric Barrier Corona Driver power supply (Information Unlimited) was used to sustain the plasma. The distance between the electrodes was 20 mm in all experiments. Voltage and frequency were kept constant throughout all experiments at 18.3 ± 0.2 kV (peak-to-peak) and 24.9 kHz, respectively. The return current values were between ca. 4 and [illegible] experimental setup was positioned inside a [illegible] Show more
Plasma Source Procedure	In a typical experiment, 100 µL of liquid sample was placed in a well on top of a glass stand inside the reactor. The distance from the nozzle to the sample was 10 mm unless stated otherwise. In experiments when the samples were at the 4 mm distance from the sample to the nozzle, the distance between the live electrode and the sample was maintained at 20 mm. Thus, the plasma length from the core plasma remained the same throughout all experiments, and the ratio of its quartz surroundings changed. The reactor was flushed with the feed gas for 20 s and then exposed to plasma for 60 s.
Plasma Medium Name	He H_2O
Plasma Medium Properties	The plasma was operated with a feed gas of helium with oxygen and water admixtures controlled by mass flow controllers (MFCs) (Brooks Instruments and Brooks Instruments 0254 microcomputer controller). All experiments were carried out with a total flow of feed gas of 2 L/min. Helium He (A Grade, 99.996%) and oxygen O_2 (Zero Grade, 99.6%) were supplied by BOC UK. All chemicals were used as received.
Plasma Medium Procedure	The experiments involving different feed gas humidity were performed by using split helium flow (i.e., by mixing dry helium with water-saturated helium in desired proportions). Water-saturated helium was made by bubbling dry helium through a water-filled Drechsel flask at 20 °C. The relative humidity was determined by weighing the flask before and after the experiment and comparing the data with the available literature values.
Plasma Target Name	H_2O_2 H_2SO_4 NaN_3 D_2O
Plasma Target Properties	Hydrogen peroxide H_2O_2 (30%), sulphuric acid H_2SO_4 (>95%) and sodium azide NaN_3 (≥99.5%) were purchased from Fluka. Deuterium oxide D_2O (99.9 atom% D), N-tert-butyl-α-phenylnitrone (PBN) (98%), 2,2,6,6-tetramethylpiperidine (TEMP) (≥99%), 2,2,6,6-tetramethylpiperidine 1-oxyl (TEMPO)
Plasma Target Procedure	In spin trapping experiments, a 100 mM solution of a spin trap (PBN, DMPO or DEPMPO) was prepared in H_2O, $H_2{}^{17}O$ or D_2O. Ozone was measured in 60 mM aqueous solutions of TEMP (sodium azide was added in concentrations of 100 mM where stated). In control experiments, solutions of each spin trap were treated with the plasma for the periods of 15, 30, 45 and 60 s.
Plasma Diagnostics Name	spin-trapping isotopic labelling EPR spectroscopy OES
Plasma Diagnostics Properties	A high voltage probe (Tektronix P6015A) and current probe (Ion Physics Corporation CM-100-L) were used with a Teledyne LeCroy WaveJet 354A oscilloscope to measure time resolved current and voltage. OES measurements of the plasma between the electrodes were performed with Ocean Optics HR-4000CG-UV-NIR spectrophotometer. Electron paramagnetic resonance (EPR)
Language	English
License	Creative Commons Attribution 4.0 International (CC BY 4.0)
Public Access Level	Public
Contact Name	O'Connell, Deborah
Contact Email	deborah.oconnell@york.ac.uk

Data and Resources

Non-thermal plasma in contact with water: The origin of species (external resource) — Go to resource
Public access to the data file (zip archive) is provided by the external...

Non-thermal plasma in contact with water: The origin of species (external resource)

Public access to the data file (zip archive) is provided by the external resource at https://doi.org/10.15124/15f674be-e9ca-4a00-9ba6-3c24e70a6aa4.

Web Page

Resources

- Non-thermal plasma in contact with water: The origin of species (external resource)

Resource filetype	html
Resource datatype	external resource
Resource range	The results of the plasma exposure of the samples (e.g., the
Resource quality	published

References:

[1] M. D. Wilkinson *et al.*, *Scientific Data* **3** (2016) 160018.
[2] GO-FAIR: FAIR Principles, https://www.go-fair.org/fair-principles.
[3] St. Franke *et al.*, arXiv:1907.07744, 2019.

SPONSORED BY THE

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