PlasTEP – Dissemination and fostering of plasma-based technological innovation for environment protection in the Baltic Sea Region

„Plasmatechnologien zur Abluft-/Abgas- sowie Abwasserbehandlung“
Rostock, 01.03.2012
Plasma: The „4th state of matter”

Electro technology
Engine building
Automotive industry
Medical engineering biotechnology
New materials chemistry

Solid
Liquid
Gas
Plasma

Ion
Electron
Neutral

melting
vaporising
ionising
New possibilities for conventional applications

- Surface modification, functionalisation
- Cleaning, disinfection up to sterilisation
- Generation of light and radiation
- Measurement, analysis
- Etching
- Coating
- Welding, cutting
- Switching
Initiator: The cluster BalticNet-PlasmaTec

R&D Institutions 38% (18 institutes/universities)

Technology Centres 7% (2 centres)

Industry 55% (27 companies)
Strategic objectives of BNPT

- Technology and market-oriented cooperation between:
  - R&D facilities & universities
  - Companies
  - Other important people from the field of plasma technology

- Develop a „Plasma technology“ cluster in the Baltic Sea Region

- Organisation of international cooperation with other dynamic regions in the world
There is a gap between research results and their implementations. Reasons for this are insufficient perceptions of potentials, particularly of decision makers from industry and public.
General Objectives

PlasTEP has the following aims:

- Dissemination and fostering of plasma-based technological innovations for environment protection in the Baltic Sea Region (BSR)
- Build up a network with partners from industry, science and policy focused on plasma technology for environment protection
- Offer new possibilities for environment neutral production
- Combining the existing knowledge about plasma technologies in the BSR
- Contribute to a better future by cleaning for example exhaust gases or waste water
- Bring the idea of investing in plasma technology and therewith in future research into the minds of industrial decision makers and politicians and show people: there are new ways!
Project Partners

01 Technology Centre of Western Pomerania (TZV) Germany
02 Leibniz Institute for Plasma Science and Technology (INP) Germany
03 VDI Mecklenburg Western Pomerania (VDI) Germany
04 Risø National Laboratory for Sustainable Energy, TU of Denmark (Risø) Denmark
05 Uppsala University, The Ångström Laboratory (UUA) Sweden
06 Lappeenranta University of Technology, ASTRal (LUT) Finland
07 Riga Technical University (RTU) Latvia
08 Lithuanian Energy Institute (LEI) Lithuania
09 Kaunas University of Technology (KUT) Lithuania
10 Vilnius Gediminas Technical University (VGTU) Lithuania
11 Institute of Nuclear Chemistry and Technology (INCT) Poland
12 The Szewalski Institute of Fluid Flow Machinery (IMP) Poland
13 West Pomeranian University of Technology (SUT) Poland
14 University of Tartu (UT) Estonia
15 Association of Polish Electrical Engineers, Szczecin Branch (SEP) Poland
Structure of PlasTEP

WP 0: Preparation Activities

WP 1: Project Management & Administration

WP 2: Communication & Information

WP 3: Plasma based technologies sustainability analysis and integration in to the educational process

WP 4: Plasma based cleaning of exhaust gases of combustion

WP 5: Removal of organic/hazardous compounds and aerosols

WP 6: Plasma technologies for water cleaning

Source: Risø (Plasma ball)
Work package 3

Plasma-based technologies sustainability analysis and integration in to the education process

- Analyses of plasma-based environmental protection solutions in respect to environmental performance and research/marketing integration potential
- Origination of basis for support of applications/investments for plasma technologies for pollutant removal
- Cost /risk analyses of different plasma applications in the BSR as a chance of a sustainable environment friendly production

PlasTEP force:
- The discussion about methodologies for implementation
- Integration of plasma knowledge in the educational process

Rostock, 01.03.2012
Cost-benefit-, eco-efficiency- and life cycle analysis

Investment- and running costs

Figure 15: Investment- and running cost comparison of waste air purification processes (50,000 m³/h) for <100 mg VOC/m³ in the flavour processing industry

Source: Company Envisolve: www.envisolve.com
Summer school and training course

Two summer schools:

• Number of participants: 19 / 28
• Students: 23, Industrial representatives: 5
• Lithuania, Poland, Spain, Cameroon, Italy, Bulgaria, Germany, Latvia, Philippines
Work Package 4

Plasma-based cleaning of exhaust gases of combustion

• Spreading information about plasma technologies reducing nitrogen oxide (NOₓ) and sulphur oxide (SOₓ) which emerge in mostly all combustion processes

• Removals are from commercialisation-ready electron beam flue gas treatment over ozonisation up to direct plasma treatment with or without catalytic reactions in laboratory scale.

• Attract interest of potential industrial users by developing an application guide

• Exchange of knowledge including a comparison of the various plasma technologies and definition of their different fields of application and (mobile) feasibility installation
Nox/Sox reduction equipment

- 161 000 EUR spent (equipment + investment)
- Catalyst filter for O$_3$ destruction has been installed
- Common experiments and direct meeting at DTU: beginning of 2012
Nox/Sox reduction equipment in a power plant

- Flue gas flow rate: 100,000 - 270,000 Nm³/h
- Pollutants removal efficiency: 95% - SO₂, 70% - NOₓ
- Total accelerators power: 1.04 MW
- Inlet flue gas parameters:
  - Temperature: 130 – 150°C
  - SO₂ concentration: 1500 – 2200 mg/Nm³
  - NOₓ concentration: 400 – 600 mg/Nm³
- Ammonia water consumption: 150 – 300 kg/h
- By-product yield: 200 – 300 kg/h

Rostock, 01.03.2012
Work Package 6

Plasma technologies for water treatment

• Joint enhancement of the new innovative method of electrical discharge plasma and photo catalyst treatment of waste water (e.g. port water)
• Pre-feasibility study of this method for cleaning water from organic compound
• Realisation of a mobile prototype for destruction of oil and oil-type leakages for acquisition of further funds and investments

Source: TU Szczecin, Plasma treatment of water
Model of the plasma skimmer
Power equipment for plasma skimmer

- Solar Panel: RICOH 155W
- DC/DC converter, MPPT, load control
- Adjustable load
- Batteries: Li-Ion CGR18650CG
Key facts

**Partnership:** Technology centres and research organisations from Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland and Sweden

**Number of partners:** 15

**Lead partner:** Technology Centre Vorpommern, Germany

**Total budget:** 3.820.000 €

Materials / Documents

Guideline for standardised test methods
Aim: Realise comparability of the partner’s results and possibility to compare different plasma technologies. It should define the model gas mixtures, the measuring conditions (pressure, temperature, mass flow) and measuring methods and will be the basis of a free open standard for future work.

Analysis of main pollution sources
Aim: The analysis of main pollution source of NOx/SOx, VOC/odour and waste water in BSR is the basis for cost-benefit analysis and should define main targets for plasma treatment.

Cost-benefit-analysis ➔ Cost model and investment preparation document
Case study by MAN B&W: base model for NOx reduction of different types of engines used for marine transportation and small district power plants to produce hot water and electricity.

www.plastep.eu/english/downloads/reportssurveys/
Thank you for your attention!

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