‘Low Energy Electron Beams for Industrial and Environmental Applications’

EuCARD2 – Scope and Aims of the Workshop

WP4 - Applications of Accelerators & WP2 - Catalysing Innovation

EuCARD-2 Workshop with Industry, 8-9 December 2016, Warsaw, Poland

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EuCARD-2 - global view to accelerator research

- **Third in a series of FP6/7 IAs on Accelerator R&D:**
  - Coordinated Accelerator Research in Europe (FP6)
    - 2003 to 2007
    - coordinated by CEA
    - 22 partners
  - European Coordination for Accelerator Research and Development
    - 2008 to 2013
    - coordinated by CERN
    - 37 partners
  - Enhanced European Coordination for Accelerator Research and Development – **Project cost 23.4M€ / 8M€ EU Contribution**
    - 2013 to 2017
    - coordinated by CERN,
    - **40 partners** (accelerator laboratories, technology institutes, universities and industry)

Accelerator Applications & Markets

- **> 30000 accelerators already in use around the World**
- Annual sales: >$3.5B
- Annual processed / treated / inspected products sales: > $500B
- **Fit into a few broad categories:**
  - Energy
  - Environment
  - Healthcare
  - Industry

  } Most of the World's accelerators

  - Security and defence
- **Accelerators for America's Future** - http://www.acceleratorsamerica.org/

EuCARD2 Work Packages

- 13 Work Packages, see http://eucard2.web.cern.ch/ for details
  - WP1: Management and Communication (MANCOM)
  - Networking Activities:
    WP2: Catalysing Innovation (INNovation)
    WP3: Energy Efficiency (EnEfficient)
    WP4: Accelerator Applications (AccApplic)
    WP5: Extreme Beams (XBEAM)
    WP6: Low Emittance Rings (LOW-e-RING)
    WP7: Novel Accelerators (EuroNNAc2)
  - Transnational Access:
    WP8: ICTF@STFC
    WP9: HiRadMat@SPS and MagNet@CERN
  - Joint Research Activities
    WP10: Future Magnets (MAG)
    WP11: Collimator Materials for fast High Density Energy Deposition (COMA-HDED)
    WP12: Innovative Radio Frequency Technologies (RF)
    WP13: Novel Acceleration Techniques (ANAC2)

WP4 & WP2 Combined workshop

- WP4 Objectives - **Accelerator Applications**
  - Review of state of the art
  - **identify existing applications that could benefit from accelerators developed for research**
  - **Identify new applications and collaborations to address them**
  - Policy document – for future development and funding
  - Website at: http://eucardapplications.hud.ac.uk/
- WP2 Objectives - **Catalysing Innovation**
  - **innovation - seen as a strategic driver of the economic development – increasing role**
  - Knowledge and Technology Transfer (KTT) – helping to form the links between researchers and industry - ultimately transfer the technology to industry
  - identify key technological areas within EuCARD-2 which were ready to engage with industry
  - Technology promotion: actively marketing the technologies from EuCARD^2 with higher maturity rate to industry

This Workshop with Industry

Low energy electron beams for industrial and environmental applications

- There are more than 10000 of these in operation
- **Developments are required at the higher energies (5-10 MeV) and for the new environmental applications.**
- **Industrial**
  - Food and agriculture, sterilization, materials processing and modification
- **Environmental**
  - Flue gas treatment (SOx, NOx,VOC), wastewater, biological sludge

Low energy electron beams for industrial and environmental applications

EuCARD-2 Workshop with Industry - 8-9 December 2016, Warsaw, Poland

Programme

(Talks time include up to 5min for questions)

Thursday 8 December 2016

Time	Title	Speaker
08.30 – 09.00	**Registration**	
09.00 - 09.15	Welcome	Prof Andrzej Chmielewski
09.15 - 09.30	EuCARD2 – Scope and aims of the workshop	Dr Vlad Skarda
State of the art: applications and accelerators - Chair: Mr Frank-Holm Rögner		
09.30 - 10.10	Industrial and Environmental Applications of Electron Accelerators: Prospects and Challenges	Dr Sunil Sabharwal
Economic aspect and reliability - Chair: Dr Bumsoo Han		
10.10 - 10.40	Electron accelerators for radiation processing - industrial application, reliability and economical aspects	Dr Zbigniew Zimek
10.40 - 11.00	**Coffee**	
Facilities using eb/X convertors for materials processing - Chair: Prof Xavier Coqueret		
11.00 - 11.30	Electron Beam assisted grafting of polymers: Endless Possibilities for Industrial Applications	Prof Olgun Güven
11.30 - 11.55	Application of electron beams for plastic packaging materials based on natural and biodegradable polymers	Prof Krystyna Ciesla
11.55 - 12.15	Use of radiation crosslinking in the production of polyethylene foam	Dr Wojciech Głuszewski
Operational experiences of demonstration plants for treatment of flue gases, waste water or solid waste - Chair: Dr Sunil Sabharwal		
12.15 - 12.45	Operation experiences on industrial scale wastewater treatment plant with e-beam	Dr Bumsoo Han
12.45 - 13.40	**Lunch**	
13.40 – 14.10	Application of electron beam irradiation in remediation of wastewaters	Prof Marek Trojanowicz
14.10 - 14.35	Operation experiences on industrial and pilot scale flue gas e-beam treatment plants.	Prof Andzej Chmielewski
14.35 - 15.00	Hybrid biogas - eb system for electricity and biofertilizer production	Mrs Urszula Gryczka
15.00 - 15.25	**Coffee**	
New developments of electron accelerators for industrial and environmental applications - Chair: Prof Andrzej Chmielewski		
15.30 - 16.00	Novel very low energy electron sources - an overview	Mr Frank-Holm Rögner
16.00 - 16.20	Facility for Gamma Activation Analysis with 8 MeV, 10 kW Linear Accelerator	Mr Mikhail Demsky
16.20 – 16.40	Mobile electron beam plant for environmental application	Dr Bumsoo Han
16.40 - 17.00	The e-beam power house - portfolio & concepts	Dr Gregor Hommes
19.00 – 21.30	**Dinner**	

Friday 9 December 2016

Electron accelerator- based technologies for sterilization - Chair: Prof Olgun Güven		
09.00 - 09.25	Sterilization of pharmaceutical packaging	Mr Werner Haag
09.25 - 09.50	FOOD-SECURITY: ebeam's role in securing the world's food supply	Dr Gregor Hommes
09.50 - 10.15	Novel mobile unit for seed treatment	Mr André Weidauer
10.15 - 10.40	Application of electron beam for the modification of medical devices	Dr Grażyna Przybytniak
10.40 - 11.00	**Coffee**	
E-beam technology vs. conventional technology - Chair: Dr Gregor Hommes		
11.00 - 11.30	Industrial applications of E-beam and X-ray - comparison with gamma	Mr Hans Hartman

11.30 - 12.00	Nanostructure aspects of UV and low energy EB-cured materials: comparing free radical and cationic curing mechanisms	Prof Xavier Coqueret
12.00 - 12.30	New and efficient method for designing dual foil electron beam forming systems	Dr Przemyslaw Adrich
12.30 - 13.20	**Lunch**	
13.20 - 13.50	Recent developments of eb/X systems and applications based on IMRP 2016 reports	Prof Andrzej Chmielewski
13.50 - 14.15	Present state and development prospects of accelerator technology in Research and Production Enterprise "Toriy".	Dr Alexander Darmaev
14.15 - 16.00	**Industrial panel discussion - Chair: Mr Hans Hartman**	
16.00 - 16.30	**Coffee and close**	

POSTERS

1. Dr Andrzej Nowicki
   Electron Beam - Induced Self-repairing Epoxy Resins.

2. Mrs Dagmara Chmielewska-Śmietanko
   Electron beam for preservation of biodeteriorated cultural heritage paper-based objects

3. Dr Marta Walo
   Application of ionizing radiation for polymer grafting

4. Ms Ewa Zwolinska
   Theoretical study of the NOx and SO2 removal from flue gas under electron beam irradiation by computer simulations

5. Mr Marcin Sudlitz
   EB irradiation of wastewater from Solvay process

6. Dr Ewa Maria Kornacka
   Radicals initiated by ionization radiation in collagen and its main components

"Low energy electron beams for industrial and environmental applications"

Panel/Discussion Session - EuCARD-2 Workshop with Industry - Questionnaire

9 December 2016, Warsaw, Poland

The aim of the workshop is to provide an overview of the state of the art and new uses/developments of electron accelerators for industrial and environmental applications, particularly those that would challenge the current technology.

For that industry panel/discussion session is being organized on Friday 9th December at 2.15-4 pm by WP2 involving key experts from industry and academia, which would be chaired by Dr Hans Hartman.

Panel Members:

- **Dr Hans Hartman - STERIS Corp., Switzerland**
- **Dr Bumsoo Han - EB TECH Co., Korea**
- **Dr Sunil Sabharwal - International Atomic Energy Agency (IAEA), Austria**
- **Prof Andrzej Chmielewski - INCT, Poland**
- **Mr Frank-Holm Rögner - Fraunhofer-Institute, Germany**
- **Dr Gregor Hommes - COMET AG, Switzerland**
- **Dr Mikhail Demsky - CORAD Ltd., Russia**
- **Prof Xavier Coqueret - CNRS, France**
- **Mr Werner Haag - METALL + PLASTIC GmbH, Germany**

People on the panel would introduce themselves and their position in the company. They would comment on the topics for the discussion and take questions from the audience:

1. **Barriers to a wider adoption of electron accelerator-based technologies (competition with conventional technologies, markets, regulatory requirements, public acceptance, engineering challenges, economic aspects …)**

2. **What do they consider the major market constraints to be**

3. **What recommendations could they make for increased use of these technologies**

Please return the questionnaire to Dr Vlad Skarda, STFC (vlad.skarda@stfc.ac.uk)

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The Future – ARIES

Follow on EU project

- **Accelerator Research and Innovation for European Science and Society –**
  - **Project cost - 28M€ / 10M€ EU Contribution**
  - May 2017 to 2021
  - coordinated by CERN,
  - **42 partners**
- Key accelerator technologies were selected for development
- **Priority was given to technologies that can benefit from the innovation potential of collaborating with industry and that have possible applications to society**
- **WP4 - 53 partners:**
  - 35 not EuCARD2 partners
  - 19 industry/users
- For possible involvement in ARIES and more information, please contact: 'rob.edgecock@cern.ch'

EuCARD²

Thank you