The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
Cultural Organization

IAEA
International Atomic Energy Agency

2227-5

Joint ICTP-IAEA Workshop on Radiation Resistant Polymers

14 - 18 March 2011

RADIATION RESISTANT POLYMERS

A. Safrany
IAEA
Vienna
Austria

14-18 March 2011
Trieste, Italy

ICTP/IAEA WORKSHOP

RADIATION RESISTANT POLYMERS

Agnes Safrany

IAEA

The IAEA is the world´s center of cooperation in the nuclear field.

Set up as the world´s "Atoms for Peace" organization in 1957 within the United Nations family.

The Agency works with its Member States and multiple partners worldwide to promote safe, secure and peaceful nuclear technologies.

IAEA Organization

Three Pillars:

- **Technology**
- **Safety & Security**
- **Safeguards & Verification**

Six Departments under Technology:

Nuclear Sciences & Applications (NA)
Nuclear Energy (NE),
Nuclear Safety (NS),
Safeguards (SG),
Management (MT),
Technical Cooperation (TC)

Context of IAEA-NA activities in support of Radiation Processing Technology

Support radiation technology development and technology transfer for:

- **addressing demographic challenges**
  (aging population – health care needs)

- **environmental challenges**
  (climate change, water scarcity, pollution, food productivity and security)

- **a safer and cleaner industrial growth.**
  (clean production processes for advanced materials)

IAEA-NA activities in support of Radiation Processing Technology

Fostering Relevant Developments and Dissemination of Information, Technology Transfer

- Coordinated Research Projects (CRP)
- Thematic Topical Meetings (Technical & Consultancy)
- IAEA/ICTP Workshops, Schools
- Collaborating Centres
- Publication of Technical Reports and Documents

Capacity Building

- Technical Cooperation Projects – Regional & National

Support to International Meetings

IMRP, IRaP, Miller, Tihany…

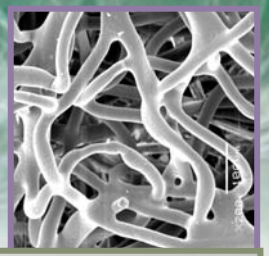
Coordinated Research Projects

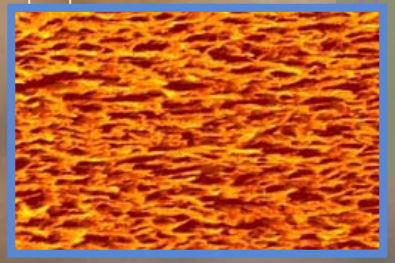
HOW IS IT ORGANIZED?

- A CRP brings together about 15 scientific institutions. (10 from developing countries - Contract holders and 5 from developed countries - Agreement holders).
- The research is done in the participant's own countries.
- The IAEA brings together the Chief Scientific Investigators at least 3 times during the course of the CRP for Research Coordination Meetings (RCMs), for face to face discussions, exchanges of progress, and to build personal bonds that will outlast the CRP lifetime.
- Through the Website, and through formal communications to its Member States, the IAEA publicises the areas of research that it has been requested to conduct, and provides the information on how prospective researchers can apply to participate in its research.

http://www-crp.iaea.org/

Coordinated Research Projects





- Development of Novel Adsorbents and Membranes by Radiation-Induced Grafting for Selective Separation Purposes (2007-2011)
- Development of Radiation-processed Products of Natural Polymers for Application in Agriculture, Healthcare, Industry and Environment (2007-2011)
- Nanoscale Radiation Engineering of Advanced Materials for Potential Biomedical Applications (2008-2012)
- Radiation Curing of Nanocomposites for Enhancing their Features and Utility in Healthcare and Industry(2010-2014)

Radiation Curing of Composites for Enhancing their Features and Utility in Healthcare and Industry(2010-14)

Expected outputs:

- Protocols for scratch and abrasion resistant coating formulations with enhanced surface finishing
- Preparation methods for new radiation curable nano-composites from natural polymers
- Specification and protocols for biodegradable packaging materials suitable for radiation sterilization
- New methods to modify surface characteristic of nano-sized materials to enhance polymer fillers interaction

Capacity building

Projects may comprise one or more of the following components:

- equipment and materials,
- fellowships and scientific visits,
- expert missions
- training courses,meetings/workshops

The TC Programme disburses >100 million USD per year in approximately 100 countries

Proposed Relevant Regional Projects 2012-13

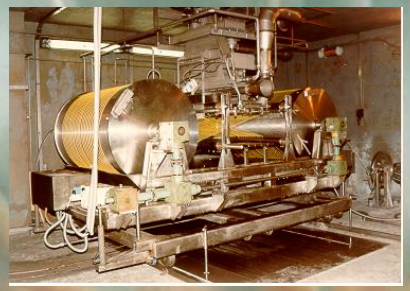
REGIONAL ASIA AND PACIFIC:
Radiation Processing for Development of Advanced Grafted Materials for Industrial Application and Environmental Preservation.

REGIONAL AFRICA:
Strengthening National Radiation Processing Capabilities in the use of natural polymeric materials for agricultural applications, environmental remediation, and health care products development.

REGIONAL EUROPE:
Radiation synthesis and characterization of nanomaterials for advanced technology, environment and healthcare products applications.

IAEA Collaborating Centre
Radiation Processing of Natural Polymers and Nanotechnology

MOSTI
MALAYSIAN NUCLEAR AGENCY
(NUCLEAR MALAYSIA)



Scope:

- Radiation processing of polymer blends and composites
- Radiation modification of polysaccharides
- Radiation curing and synthesis of palm oil acrylates
- Radiation processing of nanomaterials

Outputs:

- new products or processes
- reports, publications
- transfer of knowledge (training courses, expert missions, acceptance of fellows)

IAEA Collaborating Centre
Radiation Processing and Industrial Dosimetry

Institute of Nuclear Chemistry and Technology (INCR), Warsaw, Poland

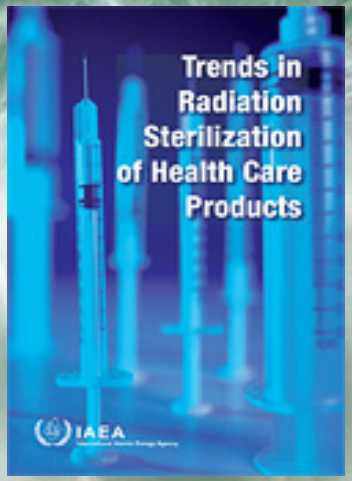
Scope:

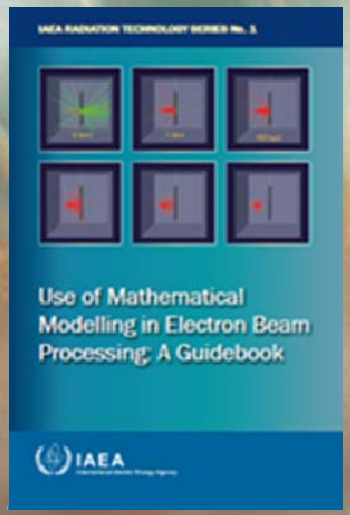
- Technological dosimetry
- QM for radiation sterilization
- Advanced applications of radiation processing

Outputs:

- Development of regional dosimetry inter-comparison system
- reports, publications
- transfer of knowledge (training courses, expert missions, acceptance of fellows)

Guidelines and Publications :





Trends in Radiation Sterilization of Health Care Products (2008)
ISBN 978-92-0-111007-7

IAEA Radiation Technology Series No. 1

Use of Mathematical Modelling in Electron Beam Processing:

A Guidebook, Vienna, December 2010

http://www-naweb.iaea.org/napc/iachem/publications.html

Industrial Electron Beam Processing (draft document ready) – in cooperation with iiA (in press)

Guidelines for Development, Validation and Routine Control of Industrial Radiation Processes (in press)

The Role of Radiation in Nanoscience and Nanotechnology (Booklet in preparation)

Events organized by the IAEA

Consultants' Meetings:

2010

- Preparation of a booklet on "The Role of Radiation in Nanoscience and Nanotechnology"
- Radiation Curing of Composites for Enhancing their Features and Utility in Health Care and Industry
- Joint NAPC/NAHU meeting on "Advances in Radiation Technology in Tissue Engineering"

2011

- Review of the Status and Trends in Radiation Processing of Agro Wastes for Biofuel Production

http://www-naweb.iaea.org/napc/iachem/meetings.html

Events with the cooperation of the IAEA:

2011

- **IMRP-2011 – International Meeting on Radiation Processing (Canada)**
  - **www.iiaglobal.org**

- **12th "Tihany" Symposium on Radiation Chemistry (Hungary)**
  - **www.tihany.kfki.hu**

Joint IAEA / ICTP Workshop:

The Abdus Salam
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Radiation Resistant Polymers

14 – 18 March 2011

(Miramare – Trieste, Italy)

WHY THIS WORKSHOP?

well-established applications of radiation resistant polymer formulations

BUT

proprietary

not widely accessible, especially for developing member states

continuous stream of a variety of new applications

POSING

significant challenges for improvement of the existing, development of entirely new radiation resistant polymers, composites and hybrid materials

Topics:

Design:

- Effects of ionizing radiation (gamma, EB, X-ray, particles) on polymers
- Mechanism of degradation
- Evaluation of radiation resistance
- Principles of increasing radiation resistance
- Examples of radiation resistant polymer formulations, blends, composites
- Self-healing phenomena in polymers

Applications:

- Medical devices (single-use and drug delivery devices) and implants containing radiation resistant formulations
- Packaging materials and sealants with enhanced tolerance for radiation
- Radiation resistant polymer formulations for applications in nuclear reactors
- Radiation resistant polymers for deep space applications

Participants presentations

Tuesday, 15. March	**14.00 – 15.20**	**Participant's presentations (4x 20 min)** **Catiker (Radiation chemistry of Nylon…)** **Damdinsuren (Effects on the PVC structure…)** **Dahlan (Radiation sterilizable PVC)** **Yasin (Effect of gamma rdaiation on …)**
Wednesday, 16 March	**11.15 – 12.15**	**Participant's presentations (3x 20 min)** **Lungenyi (Disposal of PE Packaging…)** **Pasanphan (Multifunctional biobased …stabilizers…)** **Virgolici (Preliminary tests for characterization…)**
Thursday, 17 March	**15.00 – 15.40**	**Participants presentations (2x20 min)** **Smolko (Low temperature…)** **Prakash (Synthesis of metal…)**

Thank you!

Have a successful and fruitful workshop!