

# IAEA Consultants Endorse Use of Low-Energy EB Processing

By Anthony J. Berejka

**T**echnical consultants from around the globe recently met to discuss some of the latest developments in electron beam (EB) technology. The meeting was held at the headquarters of the International Atomic Energy Agency (IAEA), in Vienna, Austria, July 21-25, 2008. Hosted by the Industrial Applications and Chemistry Section of the Division

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of Physical and Chemistry Sciences of the IAEA, the meeting was convened to discuss the "Preparation of the Status Report on Low-energy, Self-shielded Electron Accelerators and of Industrial-scale Electron/X-ray Irradiators."

The participants—Sueo Machi (Japan), Vadim Auslender (the Russian Federation), Zbigniew Zimek (Poland), Wilson Calvo (Brazil) and Tony Berejka (USA)—represented various IAEA member states and each gave presentations on the use, development and opportunities for EB processing in their area. Jean-Louis Bol, from IBA Industrial in Belgium, participated as an observer. M. Haji-Saeid, the section head, and Maria Helena Sampa, of the IAEA Industrial Applications and Chemistry Section, served as hosts and meeting coordinators.

Sueo Machi, formerly the director of the Japan Atomic Energy Research Institute (JAERI) in Takasaki, Japan, and a deputy director of the IAEA for many years, gave a presentation on the use of "Electron Accelerators for Industrial Applications in Japan." Detailed market breakdowns of accelerator use in Japan and of the commercial value added by market segment were presented. Emerging opportunities involving EB surface grafting, the use of EB for the sanitization of PET bottles and air treatment, including the use of mobile EB systems (compact EB units on trucks) were described. Dr. Machi remains active in the EB processing industry and now serves as a senior advisor to the Japan Atomic Energy Agency and as an advisor to the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT).

Vadim Auslender, from the Budker Institute of Nuclear Physics in Novosibirsk, discussed new accelerator designs developed at the institute. These included higher-energy (1 MeV) self-shielded dual-head equipment as well as new high power 7.5 to 10 MeV accelerators that can be used for sterilization purposes in lieu of radioactive gamma, Cobalt-60 sources.

Zbigniew Zimek, from the Institute of Nuclear Chemistry and Technology in Warsaw, discussed developments in X-ray processing and accelerators that can be used for that purpose. He also

reviewed low-energy equipment, including the presentation of new low-energy equipment developments in Eastern Europe, such as a 200 kV, self-shielded compact pulsed unit and presented some innovative design concepts for low-energy EB equipment.

Wilson Calvo, from the Institute for Nuclear and Energy Research (IPEN) in Sao Paulo, where RadTech South America is headquartered, described the accelerator use in South America, including those being used for surface curing. He also detailed opportunities for low-energy EB systems for treating seeds and soils to enhance crop growth and for the remediation of waste fluids used in the cleanup of petroleum storage tanks, with emphasis on the need for transportable systems that can take the beam to the place where it is needed.

Jean-Louis Bol, from IBA Industrial in Louvain-la-Neuve, Belgium, described IBA Industrial facility designs for industrial use of X-ray processing and pointed out that this non-radioactive technology was cost-competitive with gamma processing, if not a lower cost

at higher volume throughput. IBA Industrial's acceptance of an order to install a 700 kW accelerator in Switzerland for the sole purpose of using X-rays to sterilize medical disposables was mentioned.

I reviewed two papers that were presented in the EB session at the May RadTech conference in Chicago. One was the paper by Anne Testoni and colleagues from Advanced Electron Beams on the "Challenges of Using Radiochromic Films as Dosimeters for Low Voltage Electron Beams" which showed the inconsistencies of radiochromic films now being offered in the market for dosimetry. The other was a paper I collaborated on with Mark Driscoll of the State University of New York, College of Environmental Science and Forestry (SUNY-ESF), and with Daniel

Montoney from Strathmore Products, both in Syracuse, on "Routine Low-voltage Dosimetry with Thin Gauge Polyethylene Films." This paper revives a concept proposed by some of the founders of radiation chemistry, which is the use of FTIR to characterize the EB response of polyethylene (PE). The transvinylene development in PE was shown to be linear with beam current or EB exposure. I also pointed out that low-energy EB laboratory units have been



*Seated (left to right) Sueo Machi, Zbigniew Zimek, Vadim Auslender. Standing (left to right) Wilson Calvo, Maria Helena Sampa, Tony Berejka, Jean-Louis Bol.*

## About IAEA

**The IAEA is an independent organization** related to the United Nations (UN) by special agreement and is the world's center of cooperation in the radiation area. It was 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 use of nuclear technologies.

**The IAEA Secretariat is headquartered at the Vienna International Centre in Vienna, Austria.** Operational liaison and regional offices are located in Geneva, Switzerland; New York, USA; Toronto, Canada; and Tokyo, Japan. The IAEA runs or supports research centers and scientific laboratories in Vienna and Seibersdorf, Austria; Monaco; and Trieste, Italy.

**The IAEA Secretariat is a team** of 2,200 multi-disciplinary professional and support staff from more than 90 countries. The agency is led by Director General Mohamed ElBaradei and six deputy directors general who head the major departments.

**The IAEA's mission** is guided by the interests and needs of member states, strategic plans and the vision embodied in the IAEA Statute. Three main pillars—or areas of work—underpin the IAEA's mission: Safety and Security; Science and Technology; and Safeguards and Verification.

found to be effective in the development of materials that may ultimately be used with higher energies or X-rays. In addition, I summarized the current status of EB equipment, including the development of some lower cost units by equipment manufacturers in the United States. Prior to the Vienna meeting, I met with Energy Sciences, PCT Engineered Systems and Advanced Electron Beams while at the May RadTech conference.

In its conclusions, the consultants to the IAEA acknowledged the environmental benefits and energy savings of low-energy EB use and that—while lower cost units have become available—increasing market demand might even further help in lowering costs. Emerging use areas in the disinfestation of seeds and soils and in the decontamination of food

packaging materials, air and water were recognized. The IAEA was advised to assist in promoting the known benefits of low-energy EB processing to member states. To this end, the agency has a document that I co-authored with Marsh Cleland of IBA Industrial that will be available for distribution by September 2008. This document serves as an introduction to EB processing and covers all energy levels, material effects and major end-use and some emerging market applications. A May 2009 International Topical Meeting on Nuclear Research Applications and Utilization of Accelerators to be hosted by the IAEA in Vienna was also discussed. ■

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