DC ELV Accelerators: Development and Application

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ELV accelerators

- BINP develops and manufactures ELV accelerators since 1970.
- These accelerators initially were developed for application in industries.
- By now over 163 ELV accelerators had been delivered inside Russia and abroad from 1973. 120 of them are under operation until now.
BINP proposes for industrial application a series of electron accelerators of the ELV-type covering by different models:

- the energy range 0.3 - 2.5 MeV;
- the maximum beam current up to 100 mA;
- the maximum beam power 100 kW
- Special accelerator has the energy range 0.6 - 1.0 MeV, a maximum beam current 0.5 A and maximum beam power 400 kW.
The ELV accelerators are DC machines. They were designed with use of the unified systems and units. It enables to adapt them to the very specific requirements of the customer by the main parameters such as the energy, beam power, length of extraction window, etc.
ELV accelerators
ELV accelerators

• The quality of EB treatment also depends on geometrical parameters of irradiated object, extraction device and synchronization between the beam current and transportation line. For example, the irradiation of big cable with thick insulation and metal core produces inhomogeneity of absorbed dose. The accelerators can be equipped with 4-sided irradiation system to improve the homogeneity.
ELV accelerators

The four-side irradiation system. The cable is laid out under the beam in such a way that the upper and lower surfaces of this cable are swapped over at each turn.

If the beam trajectories intersect at an angle of 90° four quadrants of the cable section get irradiated in two passes of this cable under the accelerator extraction window.
**ELV accelerators**

The circular irradiation is used to irradiate the insulation of large diameter (up to 55 mm) cables. The use of this system allows one to get rid of the shadows from metallic wire core and perform azimuthally uniform irradiation in one pass of the cable under the beam. The trajectories are indicated of electrons 1 that pass through the accelerator extraction window 2 and enter the field of electromagnets 3 with pole pieces designed to curve the trajectories of electrons.

This system ensures that the dose uniformity over the cable azimuth is no worse than 15% at a beam utilization efficiency of 50%. The systems work efficiently at an electron energy in excess of 1.2 MeV.
**ELV accelerators**

Under beam transportation system allows to prevent extension of cable core and provide the synchronization of production line and beam current.
ELV accelerators

LG cable (Korea) used 3 Japan and 2 Russian accelerators. 2011 they were replaced to industrial area and were upgraded.
Electron accelerators are the most effective instruments for radiation treatment of polymers. The volume of treated product became essentially big
Bobbin with treated insulation cable
The treatment of film for producing foamed polyethylene with ELV-8 accelerator
Accelerator in local radiation shielding for treatment the tire components in China. Dimensions of accelerator with shielding are 6.5*6.5*6 м. Width of band is 1400 мм.
Two-window extraction device

1–ion pumps, 2-coils and cores of the beam scanning system, 3-protection cylinder flange, 4-protection cylinder, 5-foil blow air jet cooling, 6-frame for fixation of foil, 7-extraction foils.
Two-window extraction device for extraction 200 mA electron beam current
ELV-12 Accelerator:

Energy: 0.6 - 1.0 MeV
Beam power: 400 kW
Beam current: 500 mA
Reaction hall of accelerator
Luminescence of water by EB
ELV accelerators

BINP is research Institute and has limited possibilities for serial manufacturing of accelerators. So we have partners for comanufacturing of accelerators in China and South Korea:

Shanxi Yiruidi Electrical Technology Co. LTD.

EB Tech Co. Ltd
Thank you for attention