

LEONI *technicalreport*

Irradiation Services



Web links on this topic

- [Information on BETA cross-linking](#)
- [LEONI Studer AG, Switzerland](#)

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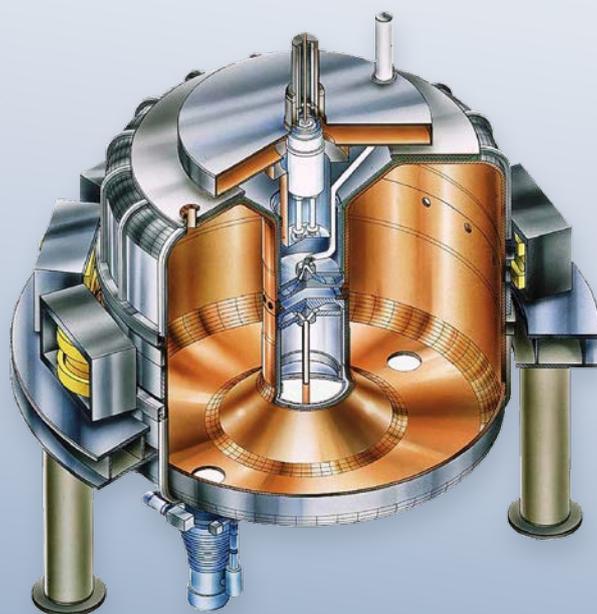
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Electron beam irradiation for processing plastics

The process of cross-linking plastics with high energy electrons is used by cable manufacturers to specifically improve certain properties.

At LEONI, the electron beam irradiation process is carried out in plants that accelerate the electrons almost to the speed of light using a voltage of up to 10 million volts in a high vacuum. As a result of the cross-linking of the polymer molecules, the BETAflam® cable and single cores treated in this manner acquire properties usually associated with difficult to process high performance polymeric materials.

For example, electron beam irradiation makes the plastic dimensionally stable under the influence of heat, resistant to chemicals, solvents and high temperatures, harder and more abrasion resistant.



For the refinement of industrial products, a modern 5/10 MeV accelerator is in use at LEONI.

Further methods of cross-linking

The alternative methods of cross-linking based on thermally induced chemical reactions "chemical cross-linking", although widespread have drawbacks which give electron-beam cross-linking certain advantages:

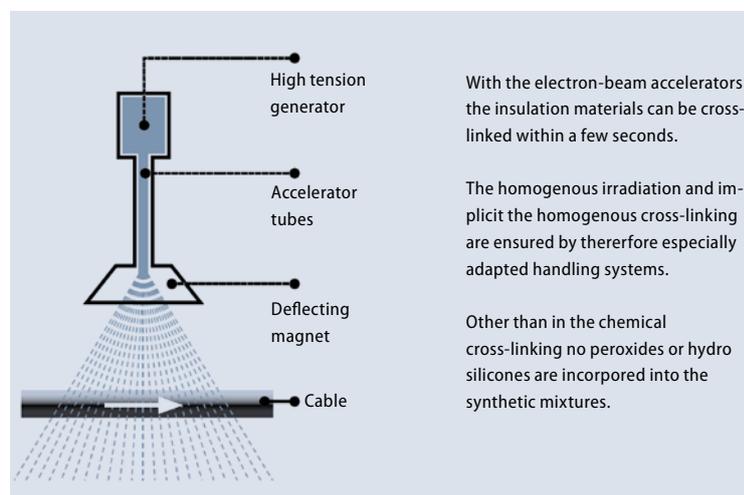
- No thermally unstable reagents need to be added to the compound. This improves long term ageing.
- The e-beam process typically involves product temperature of 40 – 60 °C whereas chemically cross-linked cables can be exposed to 160 – 200 °C. This ensures that the ageing performance is not degraded during processing.
- The by-products of both the process and the reactions that take place are significantly less hazardous with e-Beam cross-linking.
- The e-beam process is particularly suited for cross-linking flame retardant compounds due to the low thermal stress.
- With appropriately formulated compounds e-Beam crosslinking can convey temperature ratings of 90 °C and above, which can result in a significant increase in service life.

The cross-linking process is complete once the electron beam is switched off. The properties achieved are then constant subject to the normal aging processes for the product and application.

This compares favourably with the behaviour of chemically cross-linked products where an additional ageing factor is present.

>> The use of electron beam cross-linked cables offers a futureproof, environmentally friendly solution.

LEONI has a total of nine electron beam cross-linking plants at various locations. Together with other facilities LEONI has the world's most extensive range of equipment for this type of industrial processing.



With the electron-beam accelerators the insulation materials can be cross-linked within a few seconds.

The homogenous irradiation and implicit the homogenous cross-linking are ensured by therefore especially adapted handling systems.

Other than in the chemical cross-linking no peroxides or hydro silicones are incorporated into the synthetic mixtures.