CROSSLINKING AB

Accelerated electrons for the sterilisation of packaging material

In the packaging industry there is increasing interest in producing germ-reduced or aseptic packaging material.

Accelerated electrons in voltage ranges of 150 - 250 keV with penetration depth in material of density 1 of 70 - 300 µm are particularly suitable for

- surface sterilisation
- germ reduction in the depth of the packaging material.

Accelerated electrons are calculable in their penetration depth. Fig 1 shoes the ionization curve for 250 keV electrons. The ionization density (number of events) is applied, standardised to 100 %, as function of the layer thickness. Parameter is the acceleration voltage.

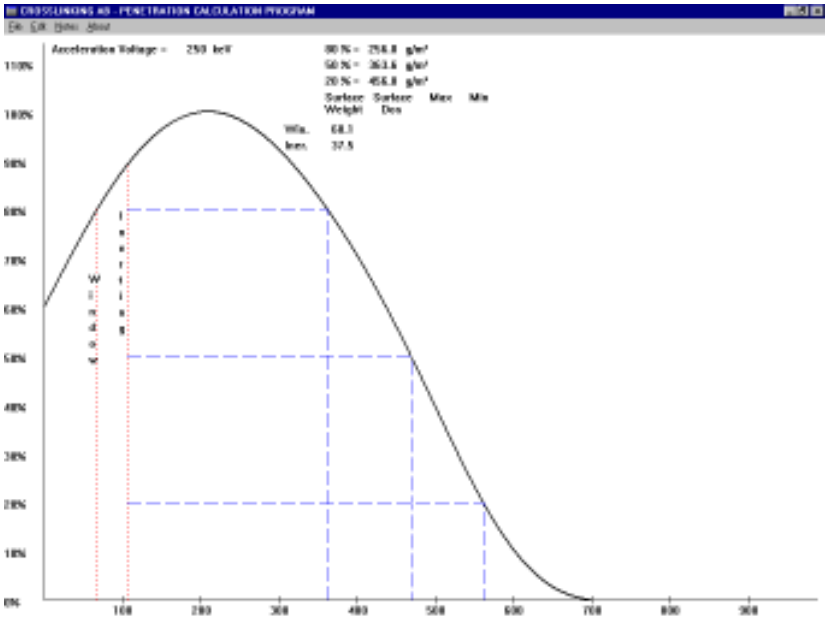

Fig. 1 Depth dose distribution for 250 keV electrons after penetration of 15 µm Ti-foil and 30 mm air gap.

As with the surface sterilisation of packaging containers are the main concern low acceleration voltages are sufficient to reach the effect wanted.

Higher acceleration voltages become necessary when the containers to be treated have a larger expanse in beam direction and therefore the way of the accelerated electrons outside the electron-beam exit window becomes longer in order to envelope the container surface with electrons from outside.

When treating deep containers it must be considered that the dose within the container declines fast, as no scattered radiation can get into the inside of the container from the side.

ELECTRON CROSSLINKING AB

Head office
Skyttevägen 42
SE-302 44 Halmstad
Sweden

Telefon / Phone
+46 (0)35 15 71 30
Telefax
+46 (0)35 14 82 06

Bruhlstraße 7
DE-72147 Nehren
Germany

Telefon / Phone
+49 (0)7473 920 281
Telefax
+49 (0)7473 920 282

Fig. 2 shows the electron cloud which makes the irradiation of three-dimensional parts possible,

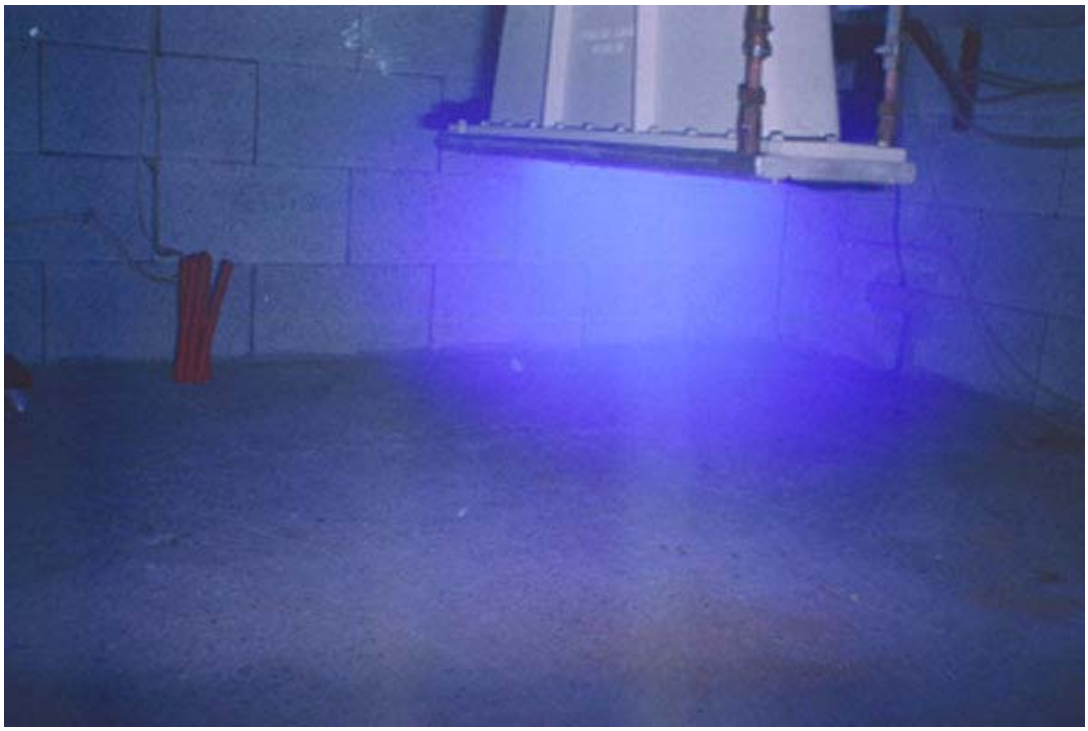

Fig. 2 Excitation of electrons in gas, $U_B = 230$ kV

Fig. 1 shows that also web-like materials can be made germ-free (within the layer) by using accelerated electrons up to layer thickness of 300 g/m^2.
A suitable facility for this shows fig. 3 and fig. 4.

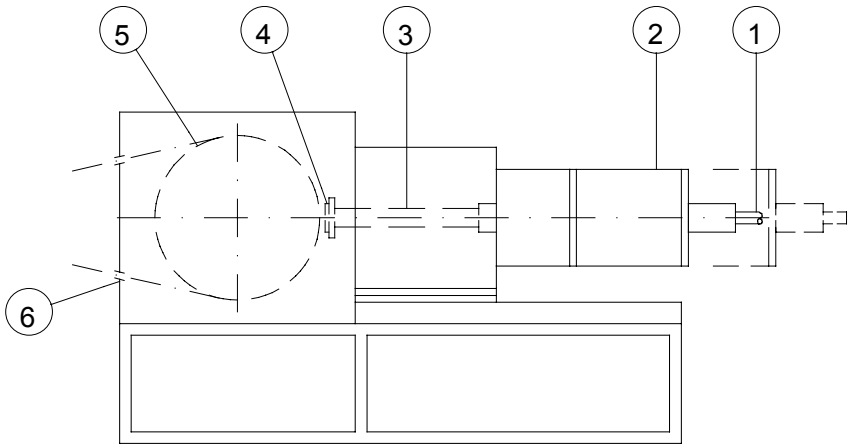

Fig. 3 EBC-irradiation unit for web-like materials (schematically)

1 High-voltage cable connection
2 Accelerator
3 Scanning system
4 Beam exit window, inertisation zone, disconnection point for maintenance work with locking system
5 Drum with infeed unit
6 Material inlet / outlet

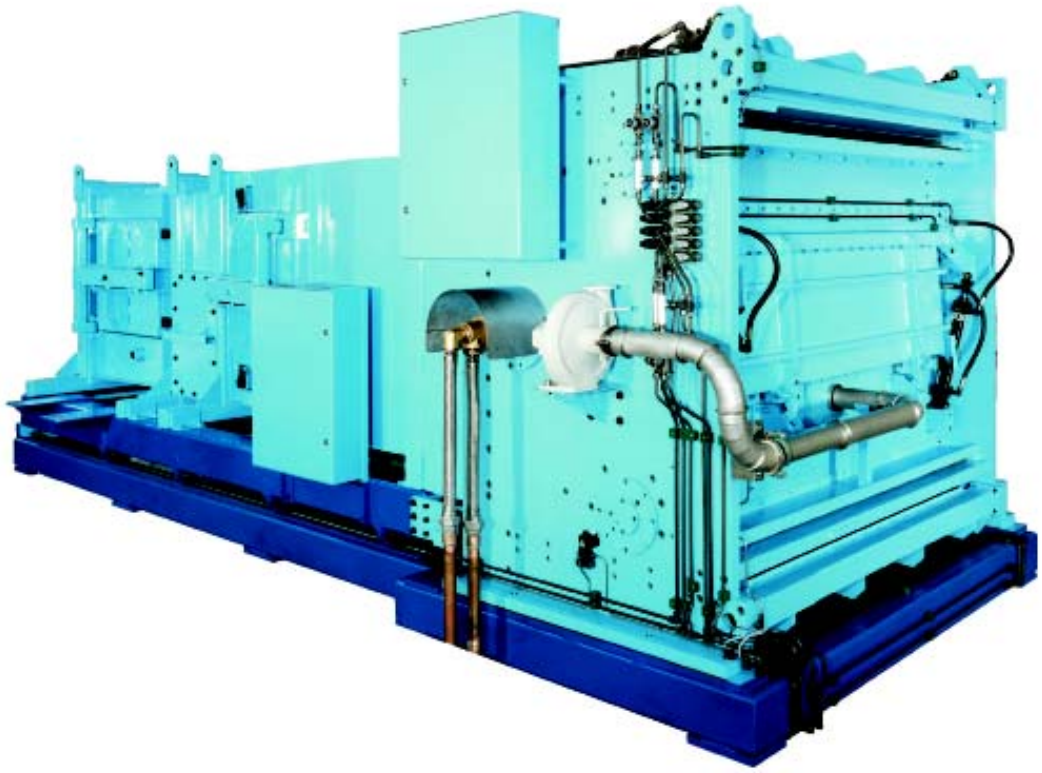

Fig. 4 EB-unit for irradiation of material from roll to roll with drum for web guidance

An internationally established value for aseptic is 25 kGy (2,5 Mrd). When making trails it showed that by using low-energy electron beams the spore suspensions of the following micro-organisms were completely killed off:

- Bacillus subtilis
- Bacillus stearothermophilus
- Bacillus coagulans
- Bacillus globigii
- Clostridium sporogenes
- Penicillium chrysogeneum
- Aspergillus niger

These micro-organisms were place in dilutions of between 300 and 6 million per drop, i.e. 6000 to 120 million per ml.

Persuasive arguments helping our customer to make a decision of the sterilisation processes:

- No emissions of EtO (Ethylen oxide).
- Minimal temperature increase through radiation process, no change of moisture level in the substrate.
- High reproduction of the radiation process, therefore minimal material losses.
- Precisely maintain sterilisation process conditions through very high dose precision over working width, depth of materials and production time.
- Substantial increase in production speed in comparison to heat treatment methods and EtO.
- Modest energy consumption
- Modest space requirements

Performance data for Electron Crosslinking AB Accelerators

- Acceleration voltage	80 - 300 kV
- Electron flow per cathode	max. 200 mA
- Working width	200 - 2000 mm
- Electron flow per cm window length	max: 3,2 mA/cm
- Speed of web at 10 kGy	up to 800 m/min
- Distribution of dosage over working width	better ± 5 %
- Productive penetration depth of electrons -incl. metals also-	max. 390 g/m^2

- No cooling of electron exit window necessary.
- The radiator may be installed in any position whatsoever.
- No measurable X-radiation outside protective screen.

Enquiries of process principle trials direct to
the manufacturer of electron radiation systems:

CROSSLINKING AB

ELECTRON CROSSLINKING AB

Head office
Skyttevägen 42
SE-302 44 Halmstad
Sweden

Telefon / Phone
+46 (0)35 15 71 30
Telefax
+46 (0)35 14 82 06

Bruhlstraße 7
DE-72147 Nehren
Germany

Telefon / Phone
+49 (0)7473 920 281
Telefax
+49 (0)7473 920 282