

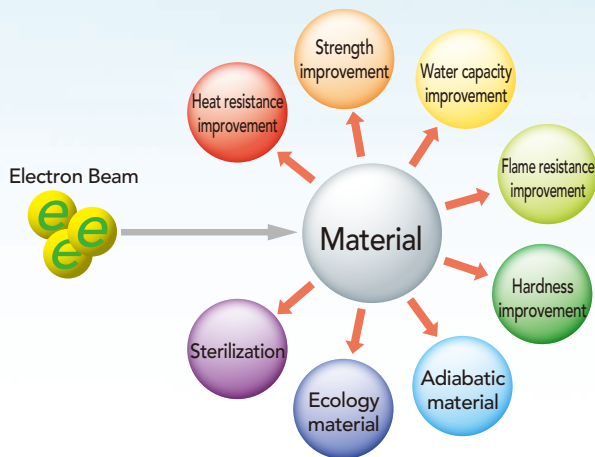
Area Beam type of
Electron beam Processing System
Curetron®

Area Beam type of Electron beam Processing System Curetron®

What is EB?

By using Electron Beam (EB) accelerated with high speed, you can obtain chemical reactions and process which are not attainable in the conventional methods of heat and light.

When EB goes through the material, EB gives its energy to the material and causes chemical reactions such as excitation and ionization at the molecular level.



EB Features

EB is the excellent method at high energy efficiency, distribution uniformity and operability.

● High energy efficiency

EB is directly irradiated to the material.

Therefore, Curetron can optimize the energy.

● High distribution uniformity

Curetron can irradiate EB to the material width with high distribution uniformity.

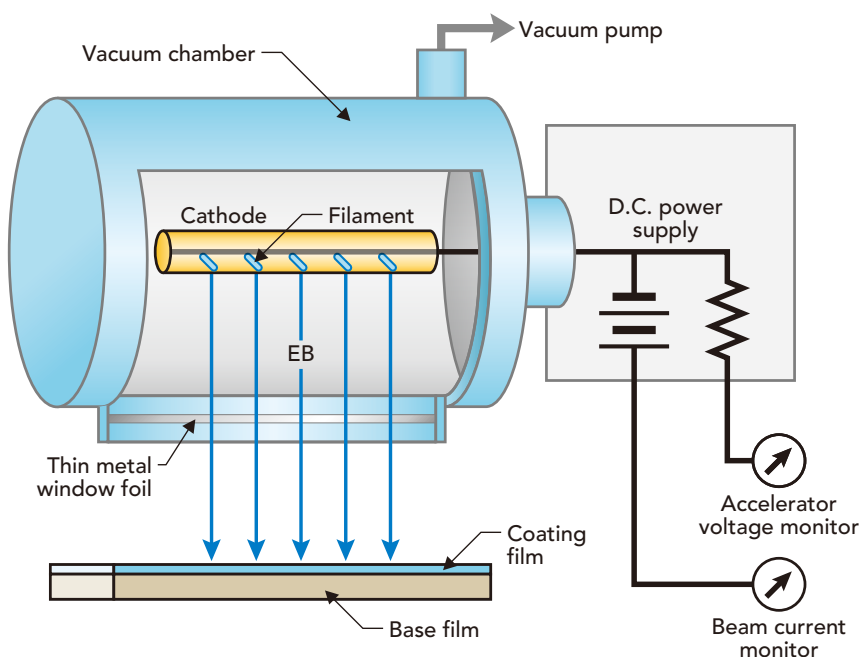
● Easy operation

You can operate Curetron easily with touch panel and switch ON/OFF.

Long time aging is not necessary.

● Safety design

Curetron has unique self-shielding structure to protect X-ray exposure. Therefore, Curetron is compact and will be used safely.



Curetron principle

Thermal electrons are accelerated in vacuum by D.C. high voltage. Then, the electron beam pass through thin metal window foil and are irradiated to the material in atmosphere.



Crosslinking

EB binds as a bridge between polymer.

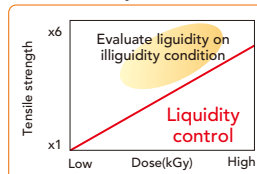
Application Fields

Tire, Cable, Film, Foamed P.E.



Pre-crosslinking for tire rubber

Dose vs Tensile strength of unvulcanized rubber

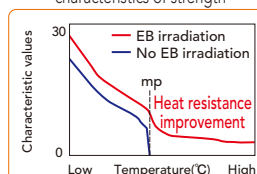


You can control rubber liquidity and reduce thickness by EB.

Effect of PE crosslinking to temperature characteristics of strength



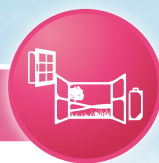
Heat resistant insulating tape



Not deformed even higher than melting temperature.

Features

- Heat resistance improvement
- Solvent resistance improvement
- Chemical resistance improvement
- Liquidity control



Graft Polymerization

EB binds polymer and another monomer and add new functions.

Application Fields

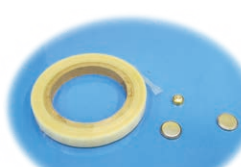
Functional Fiber or Film, Battery separator



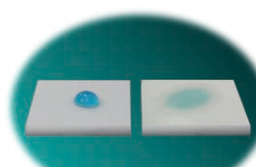
Hydrophobic



Flame retardant



Battery separator



Hydrophilic

Features

- High wash durability
- Functionalization according to use

Electron Beam Application Fields



Curing

EB polymerizes monomer to molecular with high molecular weight

Application Fields

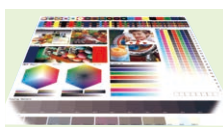
Topcoat for building material, Sign panel (hard coat), Printing, Adhesive, Laminate film, Magnetic film, Transfer film, Thermal paper, Pre-coated steel plate



Package printing



Flooring



Sign panel

Features

- Antibacterial
- Abrasion resistance
- Contamination resistance
- Available for colored paint
- Room temperature process
- Solventless



Sterilization

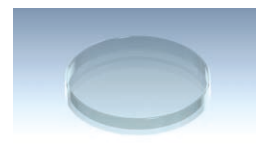
EB affects and damages the cells directly and indirectly.

Application Fields

Sterilization of Container, Medical instrument, etc.
Prevention potatoes germination



Medical instrument



Inspection tool



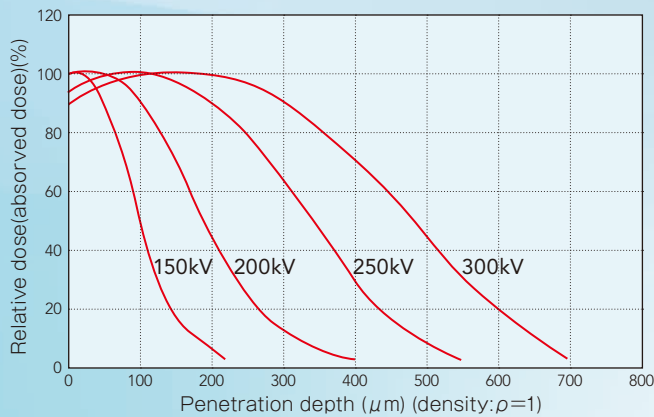
Food or medical container

Features

- Short-time process
- No residual
- Easy operability (only on/off operation)
- Low temperature rise

Penetration and accelerator voltage

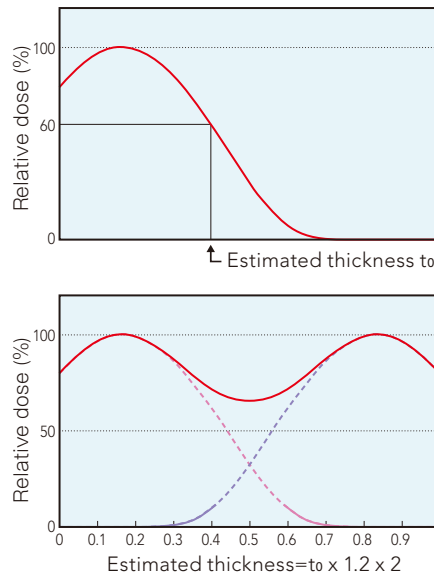
Depth-Dose curves



Accelerated electrons lose their all energy after penetrating the material at certain depth.

To show this penetration effect, Depth-Dose curves are widely used. These curves show relationship between EB penetration depth and relative energy given to the material.

Curetron®



Estimation of maximum thickness

To estimate the maximum thickness of treated material, penetration depth which corresponds to 60% relative dose is widely used (80% for curing).

When the material density is ρ , the horizontal axis scale should be divided by ρ .

Both sides irradiation is available for thicker materials or low accelerated voltage.

The maximum thickness is calculated by $t_o \times 1.2 \times 2$.

Throughput and Beam current

Unit

Generally, gray (Gy) (or radiation(rad)) is used as the absorbed dose unit.

$$1\text{Gy}=1\text{J/kg} \quad 10\text{kGy}=1\text{Mrad}$$

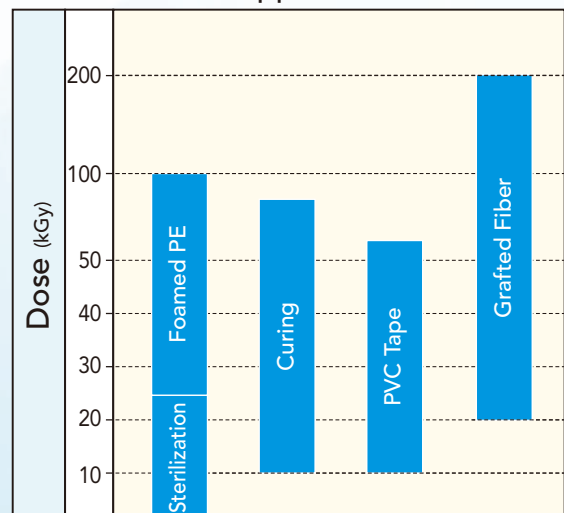
Throughput

Absorbed dose depends on beam current(I), irradiation width(W) and line speed(V) as follows.

$$D = K \cdot \frac{I}{W \cdot V}$$

K is energy loss coefficient according to each machine. Absorbed dose is proportional to I, and inversely proportional to V and W.

Dose and application field



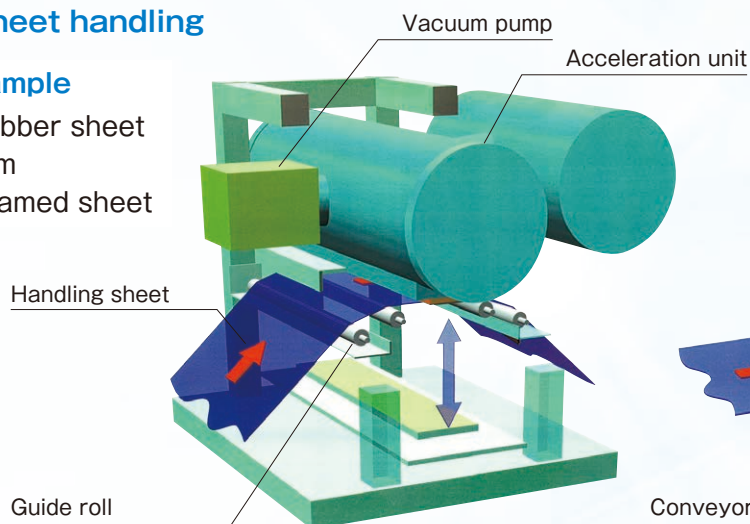
Conveyance image

NHVC can propose optimum handling system adjusted in customer use

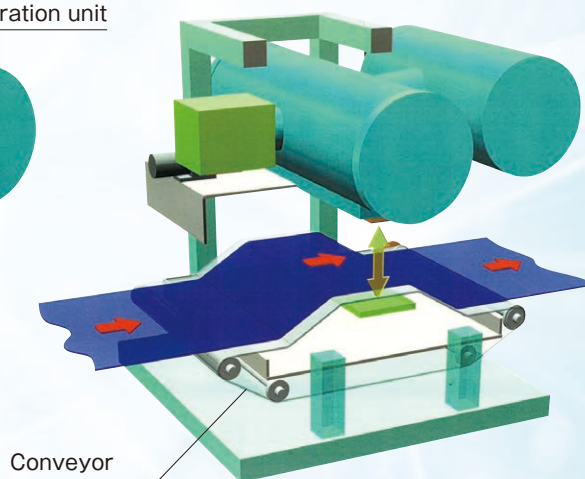
Sheet handling

Example

- Rubber sheet
- Film
- Foamed sheet



Web handling type

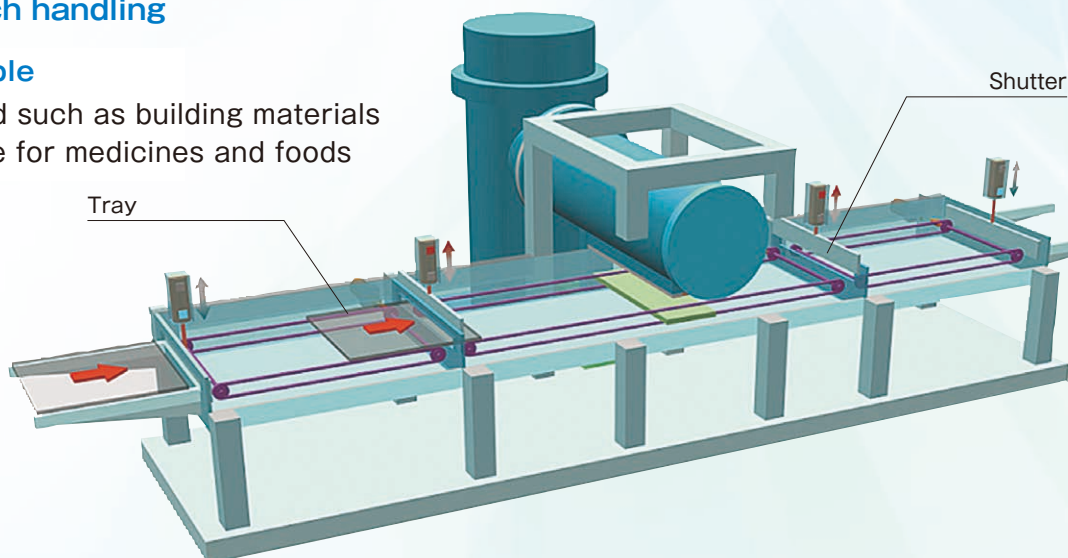


Conveyor handling type

Batch handling

Example

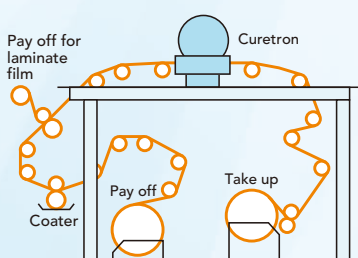
- Board such as building materials
- Bottle for medicines and foods



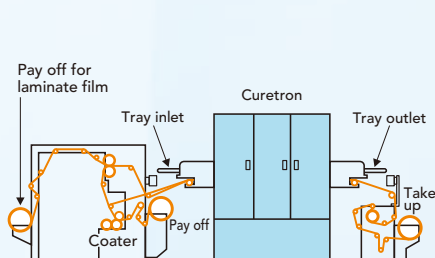
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Production system example

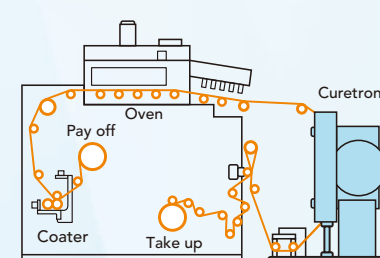
Web handling



Web and batch handling



Web handling with oven



Curetron Line-up

Curetron-150



Horizontal irradiation
Web handling type

Curetron-150 standard rating

Accelerator Voltage (kV)	150		
Beam Current (mA)	50	100	500
Irradiation Width (cm)	60	100	170

NHVC provides various technology which has been cultivated through a long time development and sale. NHVC has provided the highest level EB machines to the customers all over the world.

Curetron-200



Vertical irradiation
Web handling type

Curetron-200 standard rating

Accelerator Voltage (kV)	200		
Beam Current (mA)	50	100	500
Irradiation Width (cm)	60	100	170

EPS leading company

- Supplied over 400 EB machines around
- Applicable to various countries'

Optimum design adjusted in

- Selection of optimal irradiation condition
- Proposal according to customer's (Irradiation direction, Handling type,

Curetron-300



Vertical irradiation
Web handling type

Curetron-300 standard rating

Accelerator Voltage (kV)	300		
Beam Current (mA)	50	100	500
Irradiation Width (cm)	60	100	170

the world.
standard.

customer use

as per the testing
material and application.
Irradiation in N2 ,Water cooled roll)

Support

NHVC will support customer in the all processes of R&D, irradiation testing, contact irradiation, system introduction, and follow-up service.





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