

Technology and Application of Two Sets of Industrial Electron Accelerators

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Abstract

The radiation industry in China Academy of Engineering Physics (CAEP) has had a big scale, and the two sets of industrial electron accelerators play important roles. The Electron Processing System (E. P. S), which was introduced in 1987, is a powerful electron accelerator. And the 10Mev Accelerator, which is a traveling wave linear electron accelerator, has the higher electron energy. Both of the sets are equipped the driving devices under the beam, and has made a considerable economic results.

This article describes the technology and application of the two electron accelerators.

States of the two accelerators

1. E. P. S. Electron Accelerator

Electron energy; continuously adjustable to 3MV

electron beam; continuously adjustable to 10mA

Maximum beam power; 30kw

Scan evenness degree: $\geq 95\%$

In this accelerator, there is an underfloor chain vehicles radiation system under the beam. The main products include; The heat—shrinkable tubes, sheets and reinforced composite nets applied communication, electronics and food industry.

2. 10Mev/1mA Electron linear Accelerator

Maximum electron energy. 10Mev.

Maximum beam current; 1mA

Power; 10Kw

There is and underfloor chain vehicles radiation system under the beam. The main products include; the heat shrinkable tube and sheet, end cap, finger guard, disinfection of the Chinese medicine, color change of the gem.

Techonlogy Assurance of the Equipment in the Radiation Operation

After finished installation and debugging, the underfloor chain vehicles radiation systems were built under the beam in these two sets. To assure normal radiation operation, we improve our technology in these two accelerators in addition to the normal maintaining.

1. Improving electron gun seal packing ring on E. P. S to raise the accelerator system vacuum. Improving the per—vacuate equipment after the vacuum system exposed in air in the maintenance and repair.
2. On the 10Mev accelerator on account of the bug of the control system in operating and the backward in the control method, we are improving the technology to control in computer.
3. We are researching and developing “Continuous Radiation Production Line for Communication heat—Shrinkable tubing(under beam)” on the 10Mev accelerator, and this production line has been installing and debugging. We also have a plan to establish a continuous radiation driving equipment for electric wire and cable and heat—shrinkable tubing for domestic electric appliance on E. P. S. We will develop the products for radiation processing on these two accelerators to adapt the requirement of the radiation markets.
4. Tightening up the management and training to the accelerator operators, our staffs technology level has been developed. This is also the assurance for us to obtain the better economic performance on these two accelerators, and it is important to maintain the good operation condition for the accelerators and to improve the radiation quality.

• **Radiation Processing, Dosage Control and Quality Assurance**

The beam radiating is the key step in the producing, the radiating quality affect the product quality directly. To assure the product's quality, we must control the radiation dosage and it's evenness effectively and strictly, and adopt the suitable radiation processing.

1. Radiation processing; We use different radiation processing to adapt the products in different specification, models and materials. We have researched and tested a lot and generalized many suitable processing
2. Dosage Control; We have equipment to control the speed of the driving device strictly so that we could control the dosage precisely. Furthermore, the accelerators have to satisfy the following requirements to assure the radiation products to absorb the dosage evenly:
 - (1) The stability of the beam energy; the instability of the two accelerators' voltage is less than $\pm 20\%$.
 - (2) The stability of the beam current. We have a current stabilization system to control the accelerator's beam precisely. The instability of the beam current is less than $\pm 2\%$.
 - (3) The evenness of the beam scanning. The beam scanning width of E. P. S. is 1.2m, and the beam scanning width of 10Mev linear electron accelerator is 0.6m. We ensure the evenness of these two accelerators is bigger than 95%.

As our researching, practicing and generalizing over ten years, we have some processing and methods to suit mass production and quality assurance, the percent of pass for the radiation products is beyond 99.5%.

• **Economic Benefits**

The Electron processing System (E. P. S) went into operation in 1988, obtaining a good economic benefits in these ten years. The radiation output value totals accumulated to 15,000,000RMB (about 1,800,000 US dollars), the pure profits come up to 3,000,000RMB (about 360,000 US dollars), and we had recouped the investment in

the equipment and the factory buildings. Over twenty heat—shrinkable product factories in the Southeast China come to our company to process their products, and we have made great contribution to the socioeconomic developing and national economy construction.

• **Conclusion**

To open the radiation market and increase the utilization of the accelerators, we will improve our electron accelerator's radiation device. We are researching and developing "Continuous Radiation Production Line for Communication heat—shrinkable tubing" on the 10Mev accelerator, We also have a plan to establish a continuous radiatio driving equipment for thinwalled tubes, sheets, strengthened net, electric wire and cable on E. P. S.

Meanwhile, we are developing electron radiating for high quality special electric wire and cable, and developing radiation disinfecting for once—and—for—all injection tube for medicine and so on to open the radiation market.