

PHENOMENOLOGY OF CONDITIONING THE PELLETRON 12UD AT UTTAC

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Abstract

Several typical phenomena observed during conditioning operation of the Pelletron 12UD tandem accelerator are shown and possible causes of these phenomena are discussed.

Conditioning operation is indispensable to obtain higher terminal potential of an electrostatic accelerator. However, our knowledge of conditioning phenomena has been limited since processes in a large scale accelerator could not be observed directly and some of them seemed to be quite different from those observed in a small test machine. Three typical phenomena observed during the conditioning operation are discussed.

During the machine operation, signals from following monitors have been continuously recorded:

- 1) ionization gauges measuring pressures at the end of the low energy (L.E.) and the high energy (H.E.) tubes,
- 2) current meters reading voltage distributors column currents of L.E. and H.F. tubes and column, and
- 3) an NaI(Tl) scintillation counter monitoring x-ray emission from the terminal region.

Atypical pattern of the normal conditioning was observed when the accelerator tube was in good condition and exposed to air for some reason such as replacing stripper foils. Features of the normal conditioning pattern are,

- a) frequent (10~100/min) occurrence of small discharges with bursts of outgasing and x-ray emission,
- b) rapid decaying amplitude of these bursts as the potential kept constant
- c) small potential drop indicating that the discharge occurred in a very limited region, and
- d) existence of a critical potential gradient above which conditioning onset.

In this case conditioning progressed very smoothly. Cause of the voltage instability is considered to be microdischarges in the tube.

Another typical pattern we often observed showed following features;

- a) less frequent (0.1~1)bursts of outgasing and x-ray emission,
- b) nearly constant amplitude of the bursts for long period,
- c) a large corona current jump and the terminal potential drop at each event, and
- d) ceasing voltage of the discharge was considerably lower than the onset voltage.

Dust or microparticles in the tube are conjectured to be the cause of this instability.

The third type of the conditioning phenomena, which is considered to be electron emission in the tube, appeared recently. Tube pressure suddenly increased slightly above a certain terminal potential and almost unchanged at higher potential. X-ray emission followed the increase of the tube pressure. No ion current was observed at an end of the accelerator tube. Stable operation of the accelerator was disturbed by sudden sparking.