1MHz PULSED DUOPLASMATRON

I.Abe, S.Iwasaki, K.Onodera, R.Sakamoto,
M.Fujisawa, M.Baba, S.Itagaki

Fast Neutron Laboratory, Department of Nuclear Engineering, Tohoku University, Sendai

Abstract

The high speed arc pulsing system has been developped for Duoplasmatron ion source in our 4.5 [MV] Dynamitron accelerator.

In this study, we have improved the arc pulsing system (which was previously reported*) synchronized with a nanosecond pulsing system.

In this report, we will describe the system and the performance of the 1MHz arc pulser which is synchronized with a nanosecond pulsing system using a photo fiber isolator.

System and Performance

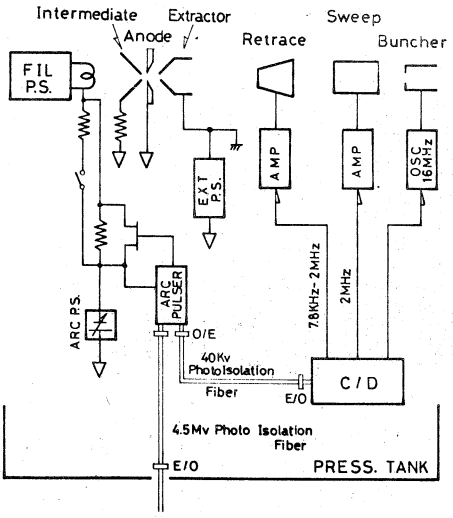
A system of 1MHz arc pulsed duoplasmatron synchronized with a nanosecond pulsing system is illustrated schematically in Fig.1.

The duoplasmatron ion source has been operating in the D.C. mode, even when a nanosecond pulsing system was running between 7.8KHz and 2MHz of repetition rate.

The ion source is at 40 [KV] potential by extractor power supply. The trigger signal from a nanosecond pulsing system to the arc pulser is transmitted by the photo fiber isolator in the terminal.

It is also possible to control the frequency and the pulse width of the arc pulser from outside of the SF6 pressurized tank through the 4.5 [MV] photo fiber isolator.

Initially we had some problems and care was taken in the first stage of the installation. At the present time, the fiber itself operates very reliably,but the PD receiver has problems from time to time.



Arc pulsed duoplasmatron synchronized with a nanosecond pulsing system.

Fig-1

The measured wave forms of arc current and voltage are shown in Fig.2 and Fig.3. The voltage across the pulser is 50 [V], and the arc current is 2 [A]. 50 [nS] of rise time and 60 [nS] of fall time was observed at 2 [A] of the arc current.

High speed, high voltage MOS FET (2SK135) is employed as a switching device in the arc pulser to improve the rise and fall time.

The duoplasmatron needs D.C. bias current (at least 100 [mA] to 300 [mA]) of the arc in the pulsed mode operation of high frequency.

The D.C. bias current improves rise time of the arc current . The ratio of D.C. bias current and pulsed current is up to 50 in the case of our duoplasmatron.

The system can be operated successfully up to 1MHz repetition rate in the present stage, and now it is expected that the life of the barium oxide coating filament and the eizel grid wire will run much longer. That is a major advantage of this system.

The arc pulser is also expected to get more beam current. The current measured is 2 times to 6 times as much as the D.C. ion source current.

It was also noticed in our experiment that the energy spread of accelerated beam was improved.

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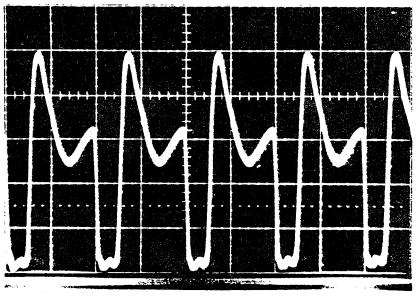

Fig.2 the switching voltage wave form.
10[V]/div. 0.5[μS]/div.

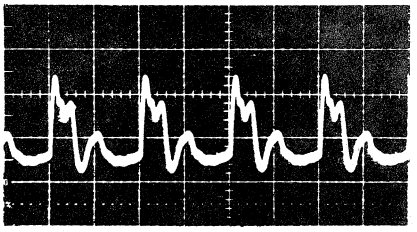

Fig.3 the arc current wave form
0.6[A]/div. 0.5[μS]/div.

*) I.Abe,et al .,"Arc pulsing system of a duoplasmatron ion source". 2nd Symp. on Accelerator Science and Technology 1978. p.17