Investigation of the Long-Term Performance of the 324 MHz Klystrons for Achieving the Efficient Operation of the Linac at J-PARC

T. Hori[1#], S. Shinozaki[1], E. Chishiro[1], F. Sato[1], M. Kawamura[1], K. Futatsukawa[1], Y. Fukui[1] and H. Oguri[1]

[1] *J-PARC Center, Tokai, Ibaraki 319-1195, Japan*

 # a corresponding author: hori.toshihiko@jaea.go.jp

The Linac at J-PARC has five klystron stations consisting of four 324 MHz klystrons. The operational power of the klystrons is different between the stations. In order to achieve the efficient operation of the linac it is important to know the tong-term performance of the klystrons under the operational conditions of the linac. In the present work the characteristics of the two klystrons, A (serial number (S/N) 0205 with operation history of 28,500 hours) and B (S/N9901 with 32,000 hours), were investigated.

The linac has been operated since November of 2006 for more than 35,000 hours. Until now four klystrons including A and B were changed with new ones or spares. The klystron A and B were found to be still available in the RF stations of the RF power of klystron lower than 1.2 MW and 1.0 MW, respectively. The long-term performance of these klystron were investigated. The results of the measurements showed that the main factor determining the life of the klystrons is the emission current of the klystron cathode as a thermionic electron source. The cathode material is made of Ir-coated, Ba impregnated M-type dispenser [1] and the emission current of the cathode generally is less than 2 A/cm^2. The life time of cathode used under the emission current of 2A/cm^2 is expected to be 145,000 hours [2]. The emission current decreases with operation time due to the degradation of the cathode. In order to operate klystrons stably, the emission current should be kept in the space charge limit region by increasing the current of the cathode heater. The operational data showed that the optimum heater current of the cathode was increased by about 1 A from the initial one during six years. From the results of the present work the cathode lifetimes of the two klystrons can be evaluated to be more than 100,000 hours. This would suggest the efficient operational method for the linac at J-PARC.

References

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