Vacuum Improvements in J-PARC 3GeV Synchrotron

The 3 GeV synchrotron (Rapid Cycling Synchrotron: RCS) in J-PARC facility is one of the highest proton beam power accelerators, aiming 1 MW beam power. The RCS was completed in 2007. Since then, the vacuum system of the RCS has been stably operated through the steady/non-steady maintenances and the additional upgrades. The basic role of the RCS vacuum system is, like other accelerator vacuum system, to maintain enough low pressure in the beam line to prevent the proton beam from being scattered by residual gas molecules. In addition, the vacuum devices are made of low radioactivation materials and/or have resistivity against radioactivation because the unavoidable beam loss would cause the severe activation in the high power proton accelerator. The design concepts and the construction of the vacuum system were reported in elsewhere by predecessors\(^1\). This report aims to introduce the upgrade in the RCS vacuum system and the vacuum status of the beam line during the accelerator operation period. For the first basic role, the TMP were added to the beam injection line in order to prevent the H\(^+\) beam from converting to H\(^0\) by the residual gas molecules. The TMP were also additionally installed in the beam acceleration section in the RCS because the exhaust speed of this section was low. The in-situ degassing method of the kicker magnet in the beam extraction section, which is large outgassing source in the beam line, was developed and practically realized. A considerable number of fluoroemastmer seal, which had been used for the connection part that leak was not be stopped by the metal seal in the first stage, was exchanged to metal seal with the bellows with very low spring constant and the light clamps of aluminum alloy for easier handling.

In this report, the description of these upgrade and the resulting achievements will be shown. Additionally, the vacuum status of the beam line, especially response to the high power beam operation will be introduced.

References