Measurement of Deuteron-Induced Activation Cross-Sections for Tantalum, Iron, Nickel and Vanadium in 33-40 MeV Region

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The IFMIF (International Fusion Materials Irradiation Facility) is an accelerator-based D-Li neutron source designed to test fusion reactor candidate materials for high fluence neutron. The IFMIF has two 40 MeV deuteron linear accelerators with each 125 mA beam current and long-term operation that total facility is 70 % at least is required in the design of it.However, deuteron beam activates the structural materials along the beam transport lines, impurity of these and corrosion materials in the Li target. These activation limits maintenance and makes long-term operation difficult. Thus the accurate estimation of deuteron-induced activity and the selection of structural materials are important.

In this work, measurements of deuteron-induced activation cross sections for tantalum, iron, nickel and vanadium were performed by using a stacked-foil technique. Tantalum is candidate material for coating to protect the beam facing materials. Iron is used as the inner material of the drift tube. Nickel is the impurity of the steel and Vanadium is corrosion material. The stacked-foil consisting of these and copper foils were irradiated with 40 MeV deuteron beam at the AVF cyclotron in TIARA/JAERI. After irradiation, the decayed gamma-rays emitted from the foils were observed by Ge detector. The ^{65}Zn activities observed from copper foils and the natCu(d,x)^{65}Zn reaction cross sectionswere used for monitoring the intensity of deuteron beam. The averaged deuteron energy in each foil position was calculated with the IRACM code. We have obtained the activation cross sections for the reactions ^{181}Ta(d,x) ^{178,180}Ta, ^{nat}Fe(d,x) ^{55,56}Co, ^{nat}Ni(d,x) ^{55}Co, ^{60,61}Cu and ^{nat}V(d,x)^{49}Cr in 33-40 MeV region. The present results will be compared with other experimental ones and the data in the ACSELAM library.