Measurements of deuteron-induced activation cross sections for IFMIF accelerator structural materials

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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. In the design of the IFMIF there are two 40 MeV deuteron linear accelerators with each 125mA beam current and long-term operation with total facility availability of at least 70% is conceived. However, activation of the structural materials along the beam transport lines by deuteron beam loss 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 order to determine the beam loss criteria. In this work, measurements of deuteron-induced activation cross sections for aluminum, copper and tungsten were performed by using a stacked-foil technique. Aluminum is the main component of the beam tube and chamber. Copper is used in the cavity walls, electrodes and magnetic conductors. For beam slits and coating to protect the beam facing materials, high-Z materials (tantalum, gold, tungsten, etc) are candidate materials. The stacked-foil consisting of aluminum, copper and tungsten foils were irradiated with deuteron beam at the AVF cyclotron in TIARA/JAERI. After irrdiation, the decayed gamma-rays emitted from the foils were observed by Ge detector. The ^{65}Zn activities observed from copper foils and the ^{nat}Cu(d,x)^{65}Zn reaction cross sections were 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 ^{27}Al(d,x)^{27}Mg, ^{24}Na, ^{nat}Cu(d,x)^{62,63}Zn, ^{61,64}Cu, and ^{nat}W(d,x)^{187}W, $^{181-184,186}$Re in 22-34 MeV region. The present results will be compared with other experimental ones and the data in the ACSELAM library and the measurements in above 34MeV and below 22MeV region will be performed in the near future.

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