OBTAINING MOLYBDENUM-99 IN REACTOR IRT-T USING RESONANCE NEUTRONS.

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^{99}Mo yield obtained from the ^{98}Mo (n,γ) ^{99}Mo reaction essentially depends on quantity of both thermal and resonance components of neutron spectrum in the nuclear reactor channel. The reaction cross-section on exposure to thermal neutrons is approximately equal to 130 mb, while an average quantity of resonance integral is 6,9 b. In connection with mentioned above, in order to reach economic efficiency of ^{99}Mo producing, in the research reactor IRT-T an attempt was made to assess an influence of thermal and resonance neutrons screening, that occurs due to other stable isotopes of the start target at the time of irradiating natural molybdenum.

It is known that in the process of irradiating molybdenum of natural isotopic composition, the flow rate of thermal neutrons (energy is up to 10 eV) for forming one ^{99}Mo nucleus is approximately by a factor of 10^2 greater than in the process of irradiating ^{99}Mo with 100 % enrichment. The reason of this fact is a relatively large absorption by ^{95}Mo, ^{97}Mo isotopes. In the energy neutron band from 10 eV to 1 keV there are 6 resonance regions. There were carried out calculations of neutron absorption quantity by other stable nuclides in resonance regions. Competitive absorption turned out to be about 10 % in the first resonance region. In the second resonance region competitive absorption is 35 %, in the third resonance region – 1,5 %, in the 4th one – about 3 %, in the 5th one – 1,5 % and in the 6th one – about 0,15 %. In general, we can assert, that the ^{99}Mo screening by other isotopes is not large in the resonance region. That is conditions for ^{98}Mo activation in the natural mixture are approximately the same as for ″pure″ ^{98}Mo activation.

For decelerating neutrons of fission spectrum the rector IRT-T has central channels beryllium-moderated (″trap″), the thickness of which is 20 – 90 min. Carried out experimental measurements of effective cross-section of the reaction (n,γ) on natural molybdenum have shown that average cross-section achieves 700 mb in these channels. Besides contribution of a resonance integral to activation is 80 %. More correct estimate of contribution of resonance component has been made for the central channel. The method of cadmium difference have been used in samples of natural MoO_3 and enriched to 98,6 % in ^{98}Mo. As a result of these

experiments the quantity of contribution have been determined: for natural oxide – 77,6 % and for enriched oxide – 67,9 %.

According to data mentioned above irradiating natural molybdenum in beryllium-moderated channels, the ^{99}Mo specific activity can be more than 2 Ci/g per 100 operating hours of the reactor (in the thermal channel the ^{99}Mo specific activity is 0,34 Ci/g in the same condition). As for using enriched targets, it can be expected that in the beryllium-moderated channels their irradiation will give much more specific activity of ^{99}Mo, which is approximately equal to enrichment factor.