Preface

There is an increasing demand of energy worldwide for the development of society. The production of electric power mostly depends on the utilization of conventional energy sources. The world is suffering from adverse effects of carbon and other pollutant emission into environment. The problem of increasing green house gases into our atmosphere can be tackled by using non-conventional sources like; Nuclear Reactors, Solar and Oceanic waves & Tidal energy etc. Among all, a nuclear reactor facilitates the use of more efficient power generation as compared to other non-conventional sources. At present, more than 400 nuclear fission reactors are working to meet the never ending energy demand of mankind. Nuclear reactors may be safe and efficient but they produce the most challenging problem of the disposal of tonnes of the radio-toxic waste produced during the operation of a conventional reactor. One of the possible ways to overcome the waste disposal problem is by developing a new sophisticated fission nuclear reactor which can provide even more efficient energy with a few interesting features of incineration of long-lived isotopes and minor actinides. Such a device was first put forward by C. Rubbia as, *Accelerator Driven Sub-critical System (ADSs)*, which uses thorium/MOX as fuel which fissions with the neutrons coming from an external supply. The reactor remains sub-critical as the neutrons' production to capture ratio for such fuels is not sufficient to carry forward the reaction on its own as can be achieved in a conventional reactor using uranium fuel. The external supply of neutrons comes from a spallation reaction of protons with a heavy material. The ADSs can be effectively used to convert the unstable long-lived isotopes or minor actinides into stable nuclei utilizing the high neutron flux environment of the reactor core.

There is a worldwide effort to develop a self sustainable working prototype tokamak, which is a fusion reactor generating energy from the fusion of two light nuclei. The tokamak is known as, *International Thermonuclear Experimental Reactor (ITER)*. ITER is capable of producing green energy and has no adverse effect on the environment. A lot of efforts are being done in order to develop such a machine and the time-line to get a working prototype is set for 2025. In ITER, a plasma of high energetic particles is produced releasing energy at very high temperatures. The heat can be utilized to produce steam to produce electrical energy. The ITER produces 14 MeV neutrons and other high energetic secondary particles which interacts with the surrounding structure and used materials causing severe changes in their mechanical properties due radiation damage. The study of effect of radiation on these surrounding materials is an active area of research these days.

Nuclear reactions and the resulting cross-section data are basic tools to study all types of phenomenon related to reactor operation and design. In the present work, neutron nuclear reaction cross-sections were measured experimentally related to ^{232}Th, which serves as a potential candidate for ADSs fuel, ^{100}Mo, a structural material and used to produce the most demanding medical isotope ^{99}Mo, and ^{58}Ni, which is used commonly used refractory metal and is used in different reactor grade alloys. In addition to above, the proton induced nuclear reaction cross-sections were also studied for the refractory metals, ^{nat}Nb, ^{nat}Ag, and ^{nat}Ti to generate precise data vital for the radiation damage, dose estimation, p-beam monitoring, radionuclide production studies etc.

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