PREFACE

There is current interest worldwide to develop new concepts of nuclear power generation and major efforts are on to realize this. Among them, accelerator driven sub-critical system (ADSs), fast reactor, compact and high temperature reactors and advanced heavy water reactor (AHWR) are the most important for power production. Besides power production, ADSs is important for incineration of the long-lived actinides and transmutation of the long-lived fission products. For the design of such reactors nuclear data such as reaction and fission cross-section of structural and cladding material and fuel elements with medium to fast neutron energies are important. The nuclear waste disposal is certainly an urgent and important challenge to be tackled to ensure future sustainable growth of nuclear power. The fuel cycle based on Thorium (Th) can address both these issues owing to a number of favorable neutronics and material characteristics which makes thorium a better fertile host.

Accelerator driven sub-critical reactor system (ADSs) demonstrated that a commercial nuclear power plant of adequate power can also be built around a sub critical reactor, provided it can be fed externally with required intensity of accelerator produced neutrons. The ADSs have attractive features for the elimination of troublesome long lived minor actinides and fission products of the spent fuel as well as for nuclear energy generation utilizing thorium as fuel. From India's perspective, which has abundant reserves of thorium, ADSs is relevant because one can also exploit its potential to design hybrid reactor systems that can produce nuclear power with the use of thorium as the main fuel. ADSs based thorium burners may need only small and limited quantities of thorium and AHWR needs small amount of uranium and plutonium to serve as starter seeds. In general, the additional degree of freedom provided by the external source in ADSs can enable one to design reactor system which primarily burn thorium fuel as well as make a more efficient use of natural uranium fuel. Therefore, ADSs seems to have the potential to provide an additional route, an efficient and economic nuclear power generation with the available thorium resources. In ADSs, the high energy neutrons were produced from the spallation reaction by bombarding the GeV energy of proton from accelerator on heavy metal target like Pb and Bi. Structural Materials used in reactors, need to fulfill two objectives. 1. They should retain their mechanical properties even after irradiation with intense neutron fluxes. 2. Neutron-induced activation should not lead to the production of long- lived radioactive waste.

In view of this, it is important to study the fast neutron induced reaction/fission cross-sections of long-lived minor actinides (Th and U), spallation target (Pb, Bi), structural and cladding materials (e.g. Zr, Nb, Fe, Cr, Mn, Ni, Y and Ag) and neutron flux monitors (e.g. Au). Because of their very low absorption cross-sections for thermal neutrons and resistance to corrosion, these materials are frequently used as cladding of fuel rods and pipe lines of secondary coolant circuit in nuclear reactors. But its cross-sections database especially for neutron threshold reactions is rather scarce. Neutron cross-section data is required for design of different components of advanced reactor. i.e., shielding design, waste estimation, estimation of radiation damage, nuclear heating, transmutation effects, radiation dose.