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Exploring Thorium as Nuclear Reactor Fuel in India - A Nuclear Data Perspective

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ABSTRACT

Energy is everywhere; literally all mass is energy. Humanity is always in search of new sources of energy, to meet the growing need for energy consumption. Nuclear fission is a known energy source, and such an energy is extracted in a reactor, from a nuclear fuel, whose nuclear property supports fission. Most of the present-day nuclear reactors around the world use Uranium as nuclear fuel. Thorium is another potential fuel, but with certain disadvantages. However, when compared with Uranium, the abundance of Thorium in the world, especially in India is very high. Scientific research is in progress to take advantage of its potential and abundance, and to overcome the shortcomings. The study essentially depends on the nuclear data. Through the available evaluated nuclear data files (ENDF), one can explore different fuel combinations and find the right fuel fractions for different reactors. These data are not ready for use and require some processing, specifically for the resonance cross-section data. The calculations require developing some computer programs. Approximate calculations of reactor parameters, especially the multiplication factor, for different nuclear fuels, are attempted in this work, to compare thorium-based fuel with other nuclear fuels. The work, though approximate will help to gain a first-hand perspective, on thorium as the future nuclear fuel in India.