NUCLEAR MATERIALS – FISSILE, FERTILE AND DUAL-USE STRUCTURAL MATERIALS INVOLVED IN NUCLEAR REACTORS

N. R. DAS*

The article presents a brief account of nuclear materials, with special emphasis on fissile, fertile and some important dual-use structural materials generally involved in nuclear reactors. The dual-use structural materials utilized in nuclear reactors have got important applications in both nuclear and non-nuclear fields. In the hostile environment, the important phenomena such as interactions between fission products and the surrounding elemental species, radiation-induced effects, corrosion, generation of gases, swelling and so forth, become increasingly complex and the performance of a nuclear reactor system thus becomes very much dependent on the physicochemical stability and nuclear compatibility of the dual-use structural materials used in fuel sub-assembly towards the fuel elements. In this context, the dual-use structural materials like stainless steel, zirconium alloys, etc. as claddings; water, liquid sodium or gases, etc. as coolants and water, boron, etc. as moderators, having good reliability and appropriate nuclear compatibility with the fuels, are of prime importance in reactor technology. In advanced designed reactors, development of novel fuels coupled with efficient dual-use structural materials may mitigate the challenges involved in optimizing the efficiency of the power reactors under specific experimental conditions.