AERB Colloquium

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Topic : **Accident Tolerant Fuel**

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There has been a renewed interest in the development of Advanced Nuclear Reactor Fuels post Fukushima to avoid/reduce hydrogen generation during postulated severe accidents. The term Accident Tolerant Fuels (ATF) was coined by the fuel designers with an ambitious objective to develop a fuel which can withstand Design Extension Conditions (DEC) to some extent with enough time for AMG actions. In the ATF development two approaches have been followed. The first being (i) coating the zircaloy-cladding/fuel-pellet with metals/alloys/ceramics, and the second being (ii) developing new alloys/ceramics to serve as claddings. Some more efforts are also dedicated in the improvements in the pellet's conductivity and resistance to degradation, by doping, there are many candidate ATFs. The most promising for the near future is Cr coating on the zircaloy cladding. The ATF development involves testing of the fuel out of pile, mainly on oxidation in steam environment and finally, in-pile tests are required before deployment. The safety enhancements due to ATF are being gauged along with the economic aspects by the designers and the utilities. Cr-coated clad, SiC composite, Mo alloy, MAX Phase, FeCrAl, etc. are considered as suitable ATF for LWRs. Some of these ATFs have been developed, tested and also irradiation of these fuel is also planned. The clad-coatings and the new alloys may lead to additional reactivity burden. In the long term, the SiC cladding is envisaged which need more R&D to augment the SiC mechanical properties for deployment as cladding. Claims are being made by ATF-developer, in terms of the improvements in the DEC coping time and quantum improvements in DBA domains. The regulations, safety margins, acceptance criteria, fuel safety analysis codes and the system level DBA-DEC safety analysis code may require some changes owing to the development of ATFs. The regulators have to get involved in the early phases of ATF developments so as to avoid any delays in the deployment of the ATFs and development of required new regulations. The important aspects related to ATF development was discussed during the talk.
