

Application of Ceramic Nuclear Fuel Materials for Innovative Fuels and Fuel Cycles

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Abstract

Nuclear fuels for nuclear power reactors currently in operation for generating electricity are mostly the ceramic UO_2 and the so-called mixed oxide, or MOX with uranium-plutonium oxide. The relevant technologies developed up to now are industrially matured, and still kept being developed in the aspect of economy and safety, including high burnup. Recently, fuel cycles with innovative fuels have been conceived and there are already preliminary results from the basic studies for the increasing interests in the incineration of excess Pu materials from warheads and surplus reactor-Pu stocks as well as minor actinides(MAs) transmutation. These concepts employ mostly ceramic nuclear fuel materials such as ZrO_2 - and Spinel-based oxide and non-oxides with ceramic matrices(nitrides and carbides). Problems that the relevant technologies face with for fuels currently used in power reactors are first briefly treated in connection with their high burnup behavior, and issues on materials for the innovative fuels and fuel cycles mentioned above are subsequently discussed in more detailed manner in view of their developmental status, material properties and irradiation behaviors studied up to the present time.