EVOLUTION OF NUCLEAR FUELS

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Nuclear fuel is the primary energy source for sustaining the nuclear fission chain reactions in a reactor. The fuels in the reactor cores are exposed to highly aggressive environment and varieties of advanced fuel materials with improved nuclear properties are continuously being developed to have optimum performance in the existing core conditions. Fabrications of varieties of nuclear fuels used in diverse forms of reactors are mainly based on two naturally occurring nuclear source elements, uranium as fissile ^{235}U and fertile ^{238}U, and thorium as fertile ^{232}Th species. The two metals in the forms of alloys with specific elements, ceramic oxides like MOX and ceramic non-oxide as mixed carbide and nitride with suitable nuclear properties like higher metal density, thermal conductivity, etc. are used as fuels in different reactor designs. In addition, efficiency of various advanced fuels in the forms of dispersion, molten salt and other types are also under investigations. The countries which have large deposits of thorium but limited reserves of uranium, are trying to give special impetus on the development of thorium-based fuels for both thermal and fast reactors in harnessing nuclear energy for peaceful uses of atomic energy.