



HEAT TRANSFER IN A FLUIDIZED BED NUCLEAR POWER REACTOR

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In order to develop a nuclear power reactor as well as developing an independent nuclear technology in Brazil, an organic coated, thorium fueled, fluidized bed nuclear reactor is under research and development. The results of the thermal design of the water-cooled fluidized bed nuclear reactor.

The conceptual design of the proposed nuclear power reactor utilizes the fluidized bed concept. The concept attempts to utilize the best known features of different reactor types. A cylindrical stainless steel calandria contains the moderator and reflector. The spherical fuel elements on the fuel pellets clad with iron are contained in the vertical calandria. The lower part of the calandria tube has a smaller diameter than its upper part and contains the fuel pellets under collapsed condition. The lower part is permanently immersed in a cooling medium. The coolant flows upward through a bed of solid fuel pellets which moves into upper part of the calandria which constitutes the reactor core and then become borne or fluidized but not transported. The velocity of the coolant can be maintained over a wide range. The lower limit is that necessary to transport the pellets to the upper part and to just buoy the solids. The upper limit is that which would just transport or carry the solids out of the bed. The bed is in a state of turbulence, and the fuel pellets are in constant motion, resulting in good mixing and high heat transfer rates.

— RESÚMENES —

It is seen that the fuel center temperature is highly sensitive to the fuel pellet diameter and to lesser extent to the heat generation rate. The exit coolant temperature is highly sensitive to the heat generation rate, the reactor height, the coolant entrance temperature and coolant flow rate. The clad temperature follows very much the same way as the coolant temperature. The variation in cladding thickness apparently does not affect the thermal parameters very much. It is seen that the axial coolant temperature gradient in the reactor is directly proportional to the ratio of fuel heat generation to the coolant flow rate. In comparison with the pressurized water reactors, while this reactor has a higher power density and the fuel twice as much in diameter, still the fuel centre temperature is much lower resulting in increased safety and efficiency of this reactor concept. It is seen that due to high convective heat transfer coefficient and large heat transfer surface, the maximum power extracted from the core is not limited

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