

Post-Irradiation Examination of Thoria and Thoria-based Fuel Experiments DME-176 and DME-221 at Canadian Nuclear Laboratories

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DME-176 and DME-221 were fuel experiments irradiated in the National Research Universal (NRU) reactor at Canadian Nuclear Laboratories (CNL) in Chalk River, Canada. The DME-176 experiment irradiated ThO₂ and (Th,Pu)O₂ fuel of 0.85-0.9 wt% Pu between 1978 and 1981 at maximum sustained linear powers of 34-55 kW/m to burnups of 59-292 MWh/kgHE. The fuel had a microstructure that was porous, inhomogeneous, and non-uniform in grain size. The DME-221 experiment irradiated ThO₂ and (Th,U)O₂ fuel of 1.0-1.5 wt% U between 2000 and 2018 at maximum sustained linear powers of 37-54 kW/m to burnups of 374-1079 MWh/kgHE. The fuel had a controlled microstructure that was non-porous, homogeneous, and more uniform in grain size. Post-Irradiation Examination (PIE) of both experiments was recently completed. PIE results of the DME-176 and DME 221 experiments will be presented, including fission gas release, ceramography, and autoradiography. Differences in fuel performance resulting from differences in fuel microstructure will be highlighted, where applicable.