Development Of Uranium, Dysprosium Oxide Pellets For Low-Void-Reactivity Fuel

Holly Hamilton – AECL
Andy Oliver, Engin Ozberk, Subir Bhattacharjee, Mikhail Ioffe – Cameco Corporation
Aniket Pant, Raheel Hameed, Dave Larkman – Zircatec Precision Industries

ABSTRACT

Low-Void Reactivity Fuel (LVRF) utilizes a "burnable" neutron absorber dysprosium oxide, Dy_2O_3, mixed with the uranium dioxide, UO_2, in the central pin, and slightly enriched uranium UO_2 in the other pins. In the LVRF design, the Dy concentration and enrichment levels can be varied to give the desired value of coolant void reactivity, and fuel burnup, respectively. The use of a fuel element containing a "burnable" neutron absorber is a significant departure from historical CANDU fuel in which the fuel is uniform across the bundle and contains only (natural) UO_2. While many of the rare earth elements can act as a burnable neutron absorber, dysprosium has the most desirable characteristics for coolant void reactivity reduction in a CANDU neutron spectrum. AECL developed LVRF during the mid-90's. More recently, Bruce Power is pursuing the implementation of LVRF in their power reactors. Commercial-scale fabrication will be provided by Cameco Corporation and Zircatec Precision Industries (ZPI). Cameco will be responsible for powder supply and ZPI will produce the pellets, elements and bundles. This paper will focus on the fabrication development activities associated with the uranium, dysprosium oxide pellets. Relationships between final pellet characteristics and fabrication variables will be presented with special emphasis on the processes of blending Dy_2O_3 and UO_2 and sintering.