ZIRLO™ Cladding and Components

Engineering Services

Background

ZIRLO material, used in fuel rod cladding, structural and flow mixing grids, instrumentation tubes, and guide thimbles, increases margin-to-fuel-rod-corrosion limits and enhances fuel assembly structural stability.

Today's trend toward high fuel burnups, extended cycles, and higher primary coolant temperatures with higher lithium demands an advanced material for use in fuel assemblies. The demonstrated corrosion resistance and enhanced structural stability of ZIRLO cladding enable longer cycle lengths at higher temperatures without reducing operating margins.

Benefits

For increased region average burnups—or for extended residence times in the core, high lithium operation, or system decontamination with the fuel in place—using ZIRLO material can result in these benefits:

- The enhanced corrosion resistance of ZIRLO material means it can tolerate longer cycle lengths at higher temperatures without reducing operating margins. Increased cycle lengths can result in significant savings for utilities by reducing fuel costs, reducing the volume of waste, and lowering spent fuel storage costs.
- There is greater fuel rod and fuel assembly dimensional stability due to reduced fuel rod and guide thimble growth and creep rates.
- Because ZIRLO cladding is more resistant to the corrosive effects of lithium, the option to use higher levels of lithium to control contamination within the coolant becomes more feasible for plant operators. This means that coolant activity and exposure of plant personnel to radioactivity can be reduced. Reducing exposure saves money by lowering maintenance costs and increasing plant availability.
- By permitting higher burnups, ZIRLO cladding can allow optimum fuel management strategies, in which an integer-batch fraction of the core is loaded each cycle, again resulting in reduced fuel cycle costs (FCCs).

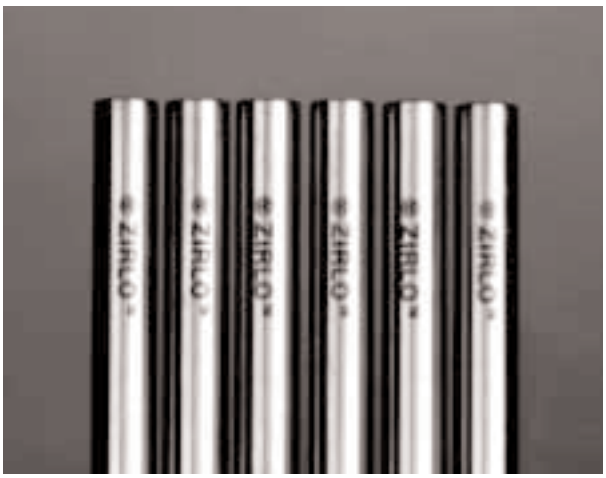
Description

One limit to extended fuel burnup or increased fuel duty is the increased likelihood of fuel rod waterside corrosion. Materials that compose the fuel rods must endure constant irradiation, high temperatures, and high pressure. Because it's essential to maintain a significant margin between design limits and actual damage levels, a new material was needed to offer more corrosion resistance than ZIRLO at very high burnups and high fuel duties.

(Continued on back)

For more information, call your local Westinghouse Electric Company sales representative.

Westinghouse



ZIRLO fuel rod cladding performs reliably at high burnups.

ZIRLO, a specially developed alloy of zirconium material with niobium, tin, and iron, is the result of an extensive search for a successor to Zircaloy-4, long a standard for PWR fuel.

This search involved a detailed analysis of 35 different compositions of zirconium alloys. Extensive testing in high-temperature, high-pressure autoclaves, microscopic evaluations of the metallurgical microstructure, and irradiation testing demonstrated the final alloy's corrosion resistance. Furthermore, ZIRLO material showed greater resistance to corrosion in tests where high levels of lithium were present in the water.

ZIRLO cladding is now a well-accepted feature of Westinghouse-supplied fuel, having demonstrated its capabilities by achieving discharge burnup levels exceeding 60,000 MWD/MTU in commercial operation.

Westinghouse Electric Company
Box 355
Pittsburgh, PA 15230

www.westinghouse**nuclear**.com

November 2004

NF-ES-0019 (71412)