

Executive Summary for Topical Report
WCAP-18126-P, “HiFi Cladding”
(Non-Proprietary)

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Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, PA 16066

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Executive Summary

HiFi Cladding Licensing Topical Report (WCAP-18126-P)

Westinghouse Electric Company LLC (Westinghouse) is preparing a licensing topical report for application of **HiFi™** material as fuel cladding in boiling water reactor (BWR) nuclear fuel. HiFi cladding will be applied to any Westinghouse licensed BWR fuel design.

HiFi material is a zirconium-based alloy designed to maximize the safety margins for BWR fuel, amid increasing demands for higher fuel duties and burnup, by reducing the hydrogen uptake. Initially developed by Nuclear Fuel Industries Ltd. (NFI), a subsidiary of Westinghouse, for use in Japan, HiFi cladding has a nominal iron content of 0.4 wt%, which exceeds the upper limit specified for Zircaloy-2 cladding. The benefits of the increased iron content are discussed below. [

] ^{a,c}

HiFi cladding refers to the outer component of the fuel cladding. [

] ^{a,c}

HiFi cladding is manufactured following the same steps as the current BWR fuel cladding material used by Westinghouse, referred to as Zircaloy-2 LK3. Processing of HiFi material [

] ^{a,c} which are tailored to the modification in chemical composition and to the equipment capabilities of the manufacturers, in order to optimize the microstructure for robust performance. The similar fabrication processes have [

] ^{a,c}

Characterization has demonstrated that the as-fabricated microstructure is almost identical between Zircaloy-2 and HiFi cladding, [

] ^{a,c}

Side-by-side out-of-pile testing comparing HiFi and Zircaloy-2 cladding demonstrates that [

] ^{a,c} This includes thermal properties, mechanical properties, corrosion properties, and [

] ^{a,c} The exception in equivalence between Zircaloy-2 and HiFi cladding is the hydrogen pickup fraction observed in HiFi cladding, being significantly lower than that of Zircaloy-2 cladding.

Table 1 summarizes the extensive irradiation testing performed [

] ^{a,c}

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[

] ^{a,c}

Table 1 Summary of irradiation experience of HiFi cladding

] ^{a,c}

All the post-irradiation examinations have demonstrated that the performance of HiFi cladding is equivalent or superior to that of Zircaloy-2 cladding. This includes in-reactor corrosion, hydrogen pickup, creep and growth. Post-irradiation mechanical (yield strength, elongation, fatigue) and [

] ^{a,c}

In particular, current approved models for [

] ^{a,c}

Extensive testing performed on Zircaloy-2 and HiFi cladding demonstrates that [

] ^{a,c} This precludes any impact on current approved analysis models and methods.

Having concluded that there are no changes in safety compliance, Westinghouse is seeking NRC approval for the use of HiFi cladding [

] ^{a,c} in all approved Westinghouse BWR fuel designs.