

Hot Functional Testing Chemistry Optimization

Background

For new nuclear power plants that are being commissioned throughout the world, pre-core hot functional testing (HFT) provides a unique opportunity to precondition reactor coolant system (RCS) surfaces at elevated temperatures and to promote the formation of protective oxide films, prior to power operation. Because the chemistry control of the coolant has a direct impact on the passivation process, Westinghouse has developed a protocol for HFT chemistry to control corrosion and to optimize the long-term integrity and performance of plant systems. This protocol is applicable to any new Pressurized Water Reactor (PWR) plant performing HFT.

Description

Our patented HFT chemistry protocol was developed using industry best practices for chemistry and HFT, as well as Westinghouse's laboratory testing and new plant operating experience. Alkaline-reducing conditions and zinc addition are utilized to form stable and protective oxide layers on system surfaces at elevated temperatures. During cooldown, shutdown chemistry conditions are simulated to release and remove corrosion products from the system. This serves to reduce the corrosion products available to deposit on the fuel ("crud") and become activated, thereby improving fuel performance and minimizing plant dose rates.

Benefits

Optimizing HFT chemistry provides multiple benefits related to:

- Materials – Maximizes corrosion resistance and preserves plant assets
- Radiation – Minimizes plant dose rates and risk for crud-related outage delays
- Fuel – Decreases the risk for crud-related fuel performance issues, increasing fuel reliability and performance

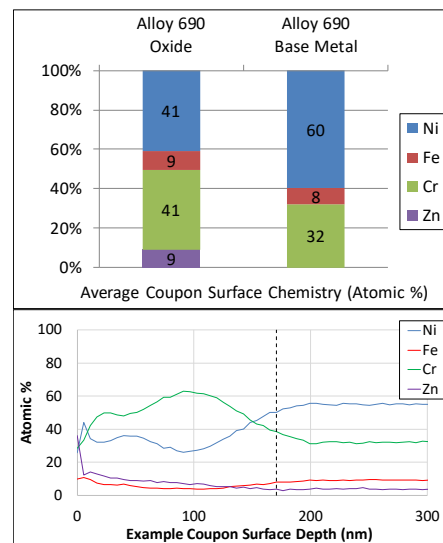
Deliverables

Westinghouse can provide a variety of services for HFT chemistry optimization, including:

- Development of HFT chemistry specifications
- Development of chemistry monitoring plans
- Review of plant procedures
- Chemistry consultation during HFT
- Evaluation of HFT chemistry implementation

Experience

The Westinghouse HFT chemistry protocol is a feature of the **AP1000**[®] plant design. This protocol has been implemented at Sanmen Units 1 and 2 and Haiyang Units 1 and 2. The benefits of the HFT chemistry were demonstrated using surface chemistry profiling of coupons that had been installed during HFT at one AP1000 plant. The analysis showed that the corrosion layer on both stainless steel and Alloy 690 was enriched in chromium and zinc, which enhances the protective nature of the oxide film.



In-Reactor Coupon Surface Chemistry Analysis Results

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