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Abstracts

George R. Engelhardt, Digby D. Macdonald, Yancheng Zhang, and R. Barry Dooley
Deterministic Prediction of Corrosion Damage in Low Pressure Steam Turbines

In this paper, the foundations of the deterministic prediction of damage due to localized corrosion in low pressure steam turbines are outlined, including the theoretical basis for predicting a complete cycle of damage development: the nucleation, growth, and death of individual events (pits/cracks) and the evolution of damage as an ensemble of events occurring in a progressive manner. The application of damage function analysis is illustrated with reference to the prediction of localized corrosion damage in low pressure steam turbines and it is predicted that deaeration of the turbine during shutdown may dramatically reduce the probability of failure at long operational times.

Robin L. Jones
Mitigating Corrosion Problems in LWRs via Chemistry Changes

Corrosion experience in U.S. light water reactor nuclear power plants is reviewed with emphasis on mitigation strategies based on water chemistry changes. While many components have suffered corrosion problems, the most costly issues to date have been stress corrosion cracking of stainless steel piping in boiling water reactors and corrosion damage to steam generator tubes in pressurized water reactors. Through industrywide R&D programs, these early-developing problems are now understood, and cost-effective countermeasures have been developed and deployed. Corrosion-related problems of current concern are briefly reviewed for both reactor types, and opportunities for chemistry-based mitigation methods are identified. It is concluded that, while tremendous progress has been made in controlling corrosion, minimizing its impact on plant operations will present a continuing challenge throughout the remaining service lives of the current fleet of U.S. nuclear power plants.

Robert Svoboda and Maurice Bodmer
Investigations into the Composition of the Water Phase in Steam Turbines

Experimental techniques to sample the early condensate in steam turbines include direct sampling, in-line sensors (e.g., conductivity), and simulating the early condensate in nozzles or in external condensation devices. The Alstom early condensate sampler is an external condensation device based on injection cooling of superheat steam. An overview of these techniques and their results indicate impurity concentrations in the range of some tens of $\mu g \cdot kg^{-1}$l to some tens of $mg \cdot kg^{-1}$, but not the highly concentrated solutions that are predicted. Visual inspections, however, deliver "footprints" of such concentrated solutions.

Albert Bursik and Miroslaw Gruszkiewicz
Drum Boilers on All-Volatile Treatment – The pH Pitfall

Hydrogen damage remains one of the major causes of boiler tube failures in fossil units with drum boilers. This is surprising since this kind of damage and its causes are adequately known. It seems that misunderstanding of the high temperature ionization behavior of ammonia and misinterpretation of the pH monitored at room temperature are the possible reasons for the high number of boilers operated on all-volatile treatment which have experienced damage. This paper discusses the impact of contaminants on the boiler water pH at the actual boiler temperature and shows adequate measures for avoiding hydrogen damage failures in units operated on all-volatile treatment.

Horst Kutzenberger, Günter Kuhnle, Gerhard Mohr, and Jörg Strohhäcker
Experience with Damage to Highly Alloyed Superheater Tubes

The efficiency of steam power stations fired by fossil fuels can be improved by increasing the steam temperature and the steam pressure. With live steam temperatures of up to 600 °C, it is no longer possible to use the previously usual tube materials. Highly alloyed ferritic and austenitic steel materials are employed for these applications. The scaling behavior is demonstrated by means of investigations of tubes which have been taken, after different operating periods, from the superheater and reheater regions.

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