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Abstracts

Modeling the Behavior of Formate, Acetate, and Carbon Dioxide in Water/Steam Cycles

Miroslaw S. Gruszkiewicz and Donald A. Palmer

Organic substances persist in high-temperature aqueous environments for varying periods of time depending on temperature, pH, contact with solid surfaces, and other factors. Since carboxylic acids and CO_2 affect the pH and can potentially play specific roles in the promotion or inhibition of turbine corrosion, it is important to be able to predict the amounts of these substances that are transferred to steam and the composition of the early condensate as a function of condensation ratio for various boiler chemistries. Such predictions can only be made using a speciated model including all the solutes. Example calculations for AVT and OT chemistry show complex relationships between early condensate enrichment ratios and boiler pressure, boiler water composition, and condensation ratio. Even small amounts of sodium and chloride below 0.1 $\mu g \cdot kg^{-1}$ in the steam are relevant to early condensate pH and carboxylic acid concentration. The calculations show that the enrichment of the early condensate relative to steam is typically 10 times greater for formate than for acetate.

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Secondary Side Chemical Cleaning of Steam Generators of Pressurized Water Reactors

Ursula Hollwedel

Chemical cleaning (CC) is a qualified, efficient method to remove not only sludge piles from the tube sheets of steam generators (SGs) but in addition scales from the heat transfer tubing. A major component of SG deposits is magnetite, which is dissolved using an organic chelating agent, usually ethylenediaminetetraacetic acid, in an alkaline, reducing environment. If copper is present in the SGs, it is removed in a separate step using organic chelants under oxidizing conditions. There are two well-known processes on the market for magnetite and copper removal, the EPRI/SGOG developed chemical cleaning process open for application by all interested companies and the Siemens/KWU developed and patented High Temperature Steam Generator Chemical Cleaning (HT-SGCC) process. The characteristic features of both processes are compared and the application and results of the latest HT-SGCCs performed with respect to the amount of deposits removed and application time are summarized.

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Snails and Mussels in Cooling Systems

Walter Guhl and Wolfgang Hater

Foreign matter in cooling systems may seriously deteriorate the effectiveness of the cooling cycle, especially if this matter reduces the regular flow of the cooling water by blocking the condenser tubes. Often, these foreign bodies are mussels and snails, which may be present in large numbers and whose shells may block the flow through the tubes. The most important species living in cooling systems are presented and their behaviour in cooling systems is described. Comprehensive studies have shown that the biocides P3-ferrocid 8591 or P3-ferrocid 8580 in combination with the biodispersant P3-ferrofos 8460 are excellent for controlling mussels and snails. This procedure is more effective if a partial stream filtration is also used at the same time.

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Impact of Different Metal Turbidities on Radiolytic Hydrogen Generation in Nuclear Power Plants

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Radiolytic hydrogen generation on gamma irradiation of turbid solutions containing metal turbidities such as titanium, nickel, iron, chromium, copper, indium, and aluminium was studied. It is suggested that the chemical reactivity of the metal in the turbid solution with radicals produced by radiolysis of water interferes with the recombination reactions which destroy hydrogen and hydrogen peroxide, thus leading to higher yield of hydrogen. The rate of generation of hydrogen and the radiolytic yield of hydrogen is related to the reactivity of the metal ion/hydroxylated species with the free radicals.

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Case Histories of Unusual Boiler Failures

Steef H. M. Vrijhoeven, Paul B. Desch, and James J. Dillon

Case histories are presented that describe atypical failures in boiler systems that are related to nonstandard or improper design, installation, materials specification, and operating practice. Some cases demonstrate how residual stresses in boiler components combine with unexpected environmental conditions to produce damage. The specific circumstances that promoted the failures are described and corrective actions are discussed.

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Utilization of Alternative Fuels in Fluidized-Bed Boilers

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The energy utilization of alternative fuels is one of the main topics for future development of recoverable resources in the European Union and in the Czech Republic. The subject of the research is combustion tests in a fluidized-bed boiler located at Štětí, Czech Republic. The experiments were carried out using Czech brown coal, wood, sewage sludge and wastes. Analyses and recommendations for optimal thermal utilization and minimization of harmful emissions were developed. The second step was thermal analyses of coal and the alternative fuels wood pellets and sewage sludge from treatment plants. From the results of the experiments and thermal modeling it is clear that 15 % alternative fuels can be used in the large fluidized-bed boilers located in the Czech Republic.

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