

Abstracts**Effect of Amines on the Surface Charge Properties of Iron Oxides**

Pascale Bénézeth, David J. Wesolowski, Donald A. Palmer, Moira K. Ridley, and Caibin Xiao

Large-scale, flow-through experiments were conducted at Chalk River Laboratories in which the deposition rate of suspended magnetite (Fe_3O_4) particles onto Inconel boiler tube walls was determined in water at 270 °C with the pH controlled nominally at 6.2 (at 270 °C) by the use of potassium hydroxide and various amine buffers (morpholine (MOR), dimethylamine (DMA), ethanolamine (ETA), and ammonia). Relative to the deposition rates in KOH solutions as the control, MOR was found to result in the highest magnetite deposition rates among the various amines, and DMA the lowest. A hypothesis was developed from this work that sorption of the protonated form of the amine onto negatively charged magnetite surfaces might enhance the deposition rate by reducing electrostatic repulsion between the magnetite particles and the boiler tube walls. This paper summarizes results of potentiometric titrations performed in 0.03 molal NaTr to determine whether MOR (200 and 250 °C) and DMA (150 and 200 °C) or their protonated cations significantly alter the proton-induced surface charge of magnetite over the range of pHs of interest in PWR secondary cycles. However, in order to measure these effects, it was deemed necessary to first establish the hydrolysis constants of MOR and DMA over the entire range of experimental conditions of the magnetite surface titrations, and in the same ionic medium.

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Organic Treatment Chemicals in Steam Generating Systems – Using the Right Tool in the Right Application

Anton Banweg

Nalco has developed organic treatment chemistries for many applications in steam generating systems to provide better performance than the traditional alternatives. Several specific applications are discussed: fluorescent organic materials for monitoring and diagnostic applications, all-polymer internal boiler water treatment for deposit inhibition, hydrazine alternatives, and engineered multiple amine products for optimal condensate system corrosion protection.

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Atmospheric Emissions from Power Plant Cooling Towers

Wayne Micheletti

Power plant recirculated cooling systems (cooling towers) are not typically thought of as potential sources of air pollution. However, atmospheric emissions can be important considerations that may influence cooling tower design and operation. This paper discusses relevant U.S. environmental regulations for potential atmospheric pollutants from power plant cooling towers, and various methods for estimating and controlling these emissions.

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Corrosion Product Sampling at Koeberg Nuclear Power Station

Nestor van Eeden and Ken J. Galt

Corrosion and corrosion product transport have a negative impact on the performance and reliability of secondary cycle systems and components. Taking a grab sample, acidifying it and measuring the iron and copper concentrations is not an effective method to measure corrosion products as the sample is not representative and results are limited to the detection level of the analytical technique employed. Koeberg has installed fixed corrosion product sampling equipment at several strategic points in the secondary system. The technique involves accumulation of the insoluble material on a filter paper over a period of time and then analysis of the deposit. A cation resin impregnated filter collects the soluble ionic material which is analysed separately. The filter papers are digested with acids and chemical analysis is performed to determine insoluble and soluble iron and copper concentrations by flame and graphite furnace atomic absorption spectrophotometry.

The sampling equipment, sample collection, analysis method, operating experience and some further developments are discussed.

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The Changing Role of Chemistry in the Power Industry

Neil B. Caris

Corrosion costs the U.S. electricity industry between five and ten billion dollars a year. In steam generating plants it is estimated that over half the forced outages are caused by corrosion, and in the U.S. industry, corrosion increases the cost of electricity more than it increases the cost of any other product, adding over 10 % to its price. The total cost of corrosion to U.S. industry is in excess of \$276 billion annually, of which more than 30 % could be prevented through the use of optimum corrosion management practices.

In order to effectively deal with these issues it will require a coordinated approach throughout the industry, in which chemistry has a major role to play. Chemistry has effectively moved from being a problem to being a solution for materials and corrosion issues, and judging by the current advances and initiatives, will continue to do so. The window of opportunity to positively influence the entire industry is here. This will be especially challenging for us as chemists in Eskom, with an ageing fleet and lack of excess generating capacity. The spin-off of taking up this challenge to "get our chemistry right" and take a quantum step forward would be a significant positive effect on the unit capability factor (UCF) and the forced loss rate (UCLF) for the Generation Division. This could, in turn, influence issues as far reaching as the cost of electricity for the South African consumer and when the construction of new generating plant is scheduled.

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The Potential of Alternative Sorbents for Desulphurization – From Laboratory Tests to the Real Combustion Unit

Zbyszek Szeliga, Dagmar Juchelková, Bohumír Čech, and Franz Winter

At present, natural limestone is used for the desulphurization of waste gases from the combustion of fossil fuels. However, it is important to save all primary resources for the future, and this applies for limestone as well. The research discussed in this paper focused on finding potential alternative sorbents for the purpose of desulphurization using the dry additive method. The article primarily describes desulphurization tests of selected substances, starting from tests in the laboratory and in pilot scale units, through tests in real combustion facilities.

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