SCALING GROWTH IN HEAT TRANSFER SURFACES AND ITS THERMOHYDRAULIC EFFECT UPON THE PERFORMANCE OF COOLING SYSTEMS

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Abstract

A new theoretical model to predict the build-up of scaling on the heat transfer surface of coolers is developed. Scaling fouling is originated as a layer of crystals of inverse solubility salts such as calcium carbonates present in cooling water, is formed on the heat transfer surface. Even though fouling cannot be fully avoided, its detrimental effect can be minimised by accurate prediction of fouling rates. Most current models for the prediction of scaling are based on a mechanism that considers mass transfer though the laminar layer and the chemical reaction between ions to form the salt. It has been observed that with such models, the velocity of deposition of crystals augments as the fluid velocity increases without a tendency to an asymptotic behaviour. Theoretically, at higher fluid velocities, it is expected that a removal phenomenon to take place with the consequent reduction in the rate of deposition. Besides, even with time, the rate of deposition cannot be maintained since velocity increases as the cross-sectional area of a tube is reduced and the inertial and friction forces tend to maintain the ion species in solution dampening the reaction. In this paper, a new model is proposed to account for the removal term. The model is validated against experimental data and its performance is compared against exiting models available in the open literature.