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THEORY OF ELECTRONIC ANTI-FOULING TECHNOLOGY TO CONTROL PRECIPITATION FOULING IN HEAT EXCHANGERS

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ABSTRACT

This paper provides a scientific explanation for the operating principle of the electronic anti-fouling (EAF) technology. The EAF technology produces an oscillating electric field via Faraday's law to provide necessary molecular agitation to dissolved mineral ions. Through improved collisions, they precipitate to insoluble mineral crystals, a process called "controlled precipitation." Hence, the level of supersaturation of the hard water significantly decreases, and new scale deposits are prevented inside heat transfer equipment. © 1997 Elsevier Science Ltd

Introduction

Scales are formed when hard water is heated (or cooled) in heat transfer equipment such as heat exchangers, condensers, evaporators, cooling towers, boilers, and pipe walls. The type of scales differs from industry to industry, depending on the mineral content of available water. Scales often observed in industry include calcium carbonate, calcium sulfate, barium sulfate, silica, iron scales, and others. One of the most common forms of scales is calcium carbonate ($CaCO_3$), which occurs naturally as an ingredient of chalk, limestone, and marble. Acidic water passing over and permeating through rocks dissolves limestone into calcium and bicarbonate ions, thereby making water hard. When the hard water is then pumped into heat transfer equipment, the calcium and bicarbonate ions precipitate due to the changes in the solubility, forming hard scales on the heat transfer surfaces, and clogging pipes and manifolds. When scales deposit in a heat exchanger surface, it is traditionally called "fouling" [1-3].