Calcium carbonate scale inhibition using the “allotropic cell” device


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Abstract

A study of the scale inhibition in water solutions induced by a galvanic device known as the “allotropic cell” is presented. The scale inhibition effect is related to the release of metal ion impurities of Zn$^{2+}$ and Cu$^{2+}$ from the surface of the device. An induced crystal structure modification of the precipitates with a trend to form the metastable aragonite structure is produced. The antiscalar effect results from changes in crystallization behavior promoting bulk solution precipitation rather than formation of adherent scale.

Keywords: Scale inhibition; Water treatment; Tyndall effect

1. Introduction

The build-up of scale formation in water systems is a serious problem, whose solution normally requires costly chemical softeners. Calcium carbonate is the predominant component of scales deposited from natural water, especially in cooling and in heating water systems.

There is ample evidence in the literature [1,2] that small amounts of metal ion impurities, notably Zn$^{2+}$, Cu$^{2+}$, Fe$^{2+}$, Fe$^{3+}$, and Mg$^{2+}$, can affect the nucleation and crystallization rates of precipitating CaCO$_3$ and induce morphological changes of the crystal habit. For example, a scale suppression effect is obtained with 1 to 1.5 ppm Zn$^{2+}$ ion, added to the water either by dosing a Zn$^{2+}$ solution or by the release of Zn$^{2+}$ ions through contact with a redox Zn-Cu alloy.