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ABSTRACT

In this study, dry sand impact and linear polarization resistance (LPR) monitoring techniques were used to study the detrimental effects of the sand size on surface morphology of the mild steel. An electrochemical mechanism was developed to measure the resistance of the metal coupons rotating in a slurry of 4 wt% NaCl and 5 wt% sand. Scanning probe microscopy (SPM) and hardness testing of the eroded coupons were conducted to elaborate their surface topography. In-depth analysis revealed that not only the larger particles but smaller particles as well caused significant erosion-corrosion of the steel coupons. It was noticed that hardness and density of the erodent particles were reasonably high to induce the plastic deformation and micro-structures at the metal surface. The LPR measurements revealed high coupon resistance in the fine sand slurry than in the coarse sand slurry. The localized corrosion and erosion-corrosion attacks on the metal surface were also supplemented with the stirring rate and the presence of NaCl in the solution. The corrosion rate was sharply increased with an increase in stirring rate above 500 rpm.

Keywords: Mild steel; Dry sand impact; Liner polarization resistance; Surface topography.

1. INTRODUCTION

Mild steel is a thermodynamically unstable material in water. The only reason that makes it so attractive material is its wide spread use in oil and gas production. In such applications, the metal surface gets covered with protective layers of corrosion product, mineral scale, oil, or inhibitors [1-4]. It is relatively easy to predict the erosion-corrosion rate of the bared metals than the covered ones. Oil and gas produced from wells inevitably contaminated with sand and other solid particles. High liquid speed with suspended particulates such as fine waste, sand and aggressive ions (sulfide and chloride) can adversely influence the performance of the mild steel as a supply line [3]. Generally, damages to the fittings and flow-lines are the consequences of