MIXED POTENTIAL THEORY ANALYSIS OF THE CORROSION RESISTANCE OF DELHI IRON PILLAR

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ABSTRACT

The famous Delhi iron pillar has endured corrosive forces for the last 1600 years. The present work has been proposed to explore the reasons responsible for its well-preserved state. It is made of an iron-based alloy with a unique composition and microstructure. The pillar's surface exhibits a patina of antimony and arsenic, in addition to the corrosion products of the iron alloy. The iron alloy is believed to be a unique composition of Fe, Mo, Cu, and Si. The present work uses mixed-potential theory to analyze the corrosion resistance of the Delhi iron pillar.

1. INTRODUCTION

The Delhi pillar situated at Mehrauli in the south of New Delhi has been the centre of attraction for historians and metallurgists all over the world as it has withstood corrosion for nearly 1600 years. The pillar is 73.5 cm high, with a column diameter of 50 cm and an arched top (Fig. 1). The diameter at the ground level is 14.6 cm, and it tapers upwards to 30.4 cm just below the decorative column which caps the column (Fig. 2). The decorative column at the top appears to have been forced into a hollow cylinder provided in the main pillar. Moreover, there is a rectangular slot (15 cm x 25 cm) in the middle (about 1/3 of the height) (Fig. 3), which must have originally contained a idol of Garuda. This is reasonable because Garuda idols are usually found on the top of many pillars erected as stupas in Buddhist complexes constructed during the Gupta period. Furthermore, there is a small pillar made for the year 148 AD at Buda in Bihar, Pakistan, which bears a similar hollow column on top of the decorative column (16 cm), which, incidentally, is of a design similar to the decorative top column of the Delhi iron pillar. The pillar exhibits a diameter of 62 cm below the ground.