Bulletin of Electrochemistry 6 (4) April 1990, pp 444–445

Corrosion-biofouling characteristics of copper in Tuticorin harbour waters

S Maruthamuthu, M Eashwar, S T Manickam, S Ambalavanan, B Venkatachari

Offshore Platform & Marine Electrochemistry Centre, CECRI Unit, Harbour Area, Tuticorin - 628 004, INDIA

and K Balakrishnan

Central Electrochemical Research Institute, Karaikudi - 623 006, INDIA

Results of 18 months' immersion studies of copper in Tuticorin harbour are presented. The corrosion-biofouling relationship is discussed based on the results of present study and of already available data in literature.

Key words: Biofouling, corrosion of copper, seawater

INTRODUCTION

Literature on the corrosion-biofouling relationship of copper is not only scanty but highly variable [1–5]. This report deals with results on the behaviour of copper in Tuticorin harbour waters and is a part of a comprehensive investigation on marine alloys under Indo-U.S. collaborative effort.

EXPERIMENTAL

Commercially available sheets of copper [99%], 1 mm thick, were cut into test panels of dimension 150 mm × 100 mm, pickled, polished, weighed and exposed to natural seawater at Tuticorin harbour during September 1987. Panels were removed in triplicate at the end of 3, 6, 12 and 18 months of immersion for assessment of corr osion and biofouling by gravimetric method.

RESULTS AND DISCUSSION

The corrosion rates of copper and biofouling load are given in Table I. As seen in Table I, copper corroded at an unusually high rate during the first six months. The higher rate of 24.5 mdd equals the extent of attack for an identical exposure period in the polluted waters of San Francisco harbour [6]. The rate was curtailed during the successive periods and at the end of 18 months the value fell to 18.8 mdd. Corrosion was characterised by severe localized attacks and impingement along edges of panels (Figs. 1 and 2).

More interestingly, biofouling has occurred in less than six months. Figure 3 shows the settlement of numerous barnacles (Balanus amphitrite and B. reticulatus) at the end of 9 months exposure. After 14 months, the corrosion products had sloughed off and settlement of Chelonibia sp. and hydroids was noted.

TABLE–I: Corrosion and biofouling of copper

Parameters	Duration of exposure (months)			
	3	6	12	18
Corrosion rate (mdd)	26.1	24.5	21.3	18.8
Fouling load (kg m^{-2})	0.4	0.65	1.1	0.9

Figs. 1 and 2: Corrosion at the end of 6 and 12 month exposure

Fig. 3: Biofouling at the end of 9 months exposure

The present results not only confirm the polluted state of Tuticorin harbour waters [7], but rekindle the controversy over corrosion - biofouling relationship for copper and its alloys. In experimenting with copper-nickel at Kure beach, Efird [2] found that the alloy was not fouled even after 14 years of exposure. This, and further experimentation on 'throwing power' of copper [3], led the author to contradict the famous 'leaching rate-theory' [1] and postulate that the

antifouling property of copper revolves around the nature of corrosion product. Recent studies[5] have brought renewed interest in the subject by providing evidence to the theory on mobile copper. Blunn [4] has also examined the relationship and suggested that both theories were found to work in practice. The present results provide overwhelming evidence for Efird's concept.

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