



Short communication

Cement particle induced failure of cold potable water copper plumbing

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1. Introduction

Use of copper tubing in water distribution system reportedly dated back to the ancient Egyptians who used copper pipe rolled from sheets. Copper is known to be relatively corrosion resistant in potable water and widely used as domestic plumbing material. However, the insidious and unpredictable internal pitting corrosion, although rare, is identified to be the leading cause of domestic copper plumbing failure in potable water system [1–5]. The pinhole leakage of copper tubing in cold potable water distribution due to pitting corrosion is in general found to be induced by either aggressive water chemistry (typically pH of 7.0–7.7 and dissolved carbon dioxide of at least 25 mg/L) or soldering flux. Severe corrosion of copper in the presence of aluminum and chlorine also evidently lead to the pinhole leakage of copper as has been revealed in recent studies [5–10].

The copper tubing for domestic cold potable water distribution system in the 13 storied condominiums in a South East Asian tropical island has suffered premature pinhole leakage failure. According to the design the copper tubing should serve at least 10 more years smoothly. The pinhole leakage was most severe in 13th floor where the property management office is situated and also in noticeable number in the 8th and 7th, while almost absent in the rest of the floors of the condominium. One section of leaking copper tubing (approximately 72 cm length with 2.8 cm diameter) from the 13th floor (see Fig. 1) was brought to laboratory to for analyzing the cause of failure. The tubing of the water supply system was with differential diameter (5.4 cm and 2.8 cm, respectively) and made of C12200 copper alloy. The objective of this paper is to determine the main cause of this failure describing the detailed metallurgical investigations on failed copper tubes.

2. Experimental results

2.1. Visual examination

Visual examination of as received sample has revealed that the pinhole leaks are at: (i) one end of the supplied copper tube (see Fig. 1a) which was joined with tube of larger diameter, and (ii) mostly in the 6-O'clock position with few in

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