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Failure analysis of austenitic stainless steel pipes in amine liquid regeneration unit of a desulfurizer

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Abstract: Failure investigation was carried out on the austenitic stainless steel pipes of an amine liquid purification unit. The authors investigated the causes of the pipe failure by analyzing chemical compositions of materials and corrosion products, observing microstructures, and testing the pitting corrosion resistance of materials. The results showed that the failure was caused by pitting corrosion due to the presence of chlorine ions in the working medium. Another important cause of pitting corrosion was the decrease of corrosion resistance of welds owing to the microstructural changes taken place during welding. A large amount of sulfate ions in the working medium accelerated the pits growth. At the same time, proposals were put forward to the user of the failure pipes.

Keywords: Pitting corrosion; Weld; Austenitic stainless steel; Amine liquid regeneration unit

1. Introduction

Weld joints between the pipes of an amine liquid regeneration unit in a petrochemical company leaked after a service life of 50 days. The base material of pipes is Type 304L austenitic stainless steel, which is equivalent to Type 022Cr19Ni10 of Chinese standard. Manual arc welding using E308L electrode was employed to join the pipes together. The medium in the amine liquid purification unit is lean amine with pH value of around 4.5, which contains 130-140 g/L sulfate ions, 20-60 ppm chloride ions, and trace amount of sulfurous acid ions. Pipe service temperature ranged from 95 °C to 100 °C. Fig. 1 shows one of the failed pipes including the elbow and straight pipe.

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