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Detection of Hydrogen Attack by Ultrasonic Attenuation Measurements in Carbon Steel Top Forging of Ammonia Converter

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Abstract

The hydrogen attack was noticed in Chemico designed (Design temp 460 °C, Pressure 204 kgs/cm²) Ammonia Converter, Carbon Steel top forging after the plant was in service for nine years. The first set of attenuation readings were taken on September 1971 in both top and bottom forging, before the converter were commissioned, for future reference. The hydrogen attack was increased to a depth of 10 mm in 1985 and 16 mm in 1991. The observation was concurred by M/s. Mitsubishi Heavy Industries, Japan, Inspection Personnel during their visit in 1980, 1985 and 1991. The in situ metallography carried out on the internal surface of the forging on the suspected locations during converter catalyst change also confirmed the inspection observation.

The safety of the Converter was assured by external ultrasonic attenuation measurements during every turn-around as well as by putting steam/condensate quench around the forging during on-stream, to reduce the forging temperature. Besides improvement in canister assembly, carrying out continuous monitoring of the forging skin temperature by installing several thermocouple points and by using infrared thermometer as well.

The Chemico Ammonia Converter was in service without forging replacement, for a further period of 11 years till Topsøe Radial S-200 Converter was installed

The objective of presenting this paper is to highlight the usefulness of NDT in upkeep of the plant production and the morale of operating staff, for smooth and safe operation of the plant.