

SPA7. Steel Crack Origin Investigation

Rozena Turner, North Harris College

Introduction

The poster will illustrate an investigation of a crack in a weld part of 4130 steel to determine if heat treating caused the crack. There are three factors which combine to cause cracking: 1) hydrogen generated by the welding process, 2) a hard brittle structure (transformation of austenite to martensite) which is susceptible to cracking, 3) residual tensile stresses acting on the welded joint. Cracking may be caused by the diffusion of hydrogen to the highly stressed, hardened part of the welding. Heat treating can cause cracks from stresses developed from unequal heating or cooling of a part during heat treatment.

Technical Approach & Results

Included will be photos of the microstructure of the steel near the crack area and away from the crack. The photos will show carbon loss due to exposure to air during the heat treating process.

Data will include steps involved in sample preparation as cutting, grinding, polished and etching samples to reveal microstructure under the Optical Microscope. One of the micrographs will show microstructure of a properly heat treated steel.

Conclusions

A microscopic examination shows that the area surrounding the crack has decarburized and oxidized. The loss of carbon in the cracked area could have occurred during heat treating, because that cracked area was open to air. That would indicate that the crack existed before the heat treating process. Several causes of cracks in steel are yet to be determined when quenching high carbon and low alloy steels. Uneven heating and cooling in the welding process may have been the cause of cracking. Cracks of a circular form, from the corners or edges of a part, indicate uneven heating and cooling in hardening. Cracks of a vertical nature and dark-colored fissures indicate that the steel has been burned (exposed to high temperature).