Acta Microscopica, Vol. 8 Supplement A October 1999
Proc. XVII Congress of the Brazilian Society for Microscopy and Microanalysis and X Congress of the Brazilian Society for Cell Biology

CRACKS CAUSED BY INCLUSIONS ON AISI 409 WELDED TUBES FOR CARS EXHAUST SYSTEMS

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Ferritic stainless steel AISI 409 welded tubes was chosen for cars exhaust systems in the beginning of 90's, due to heat resistance and price levels (1). Although Brazilian AISI 409 welded tube market has been consolidated, quality problems as cracking during bending and expanding tube operation has appeared at initial development period. Present work investigates causes which are related to Ca inclusions detected by Scanning Electronic Microscope (SEM) and EDS.

INTRODUCTION

AISI 409 welded tubes are submitted to strong deformation, before becoming a car exhaust system line. TIG welding process was chosen to produce these tubes in Brazil, carachterized by heterogeneous welded zone. Some initial details on AISI 409 chemical composition, were involved on cracking failures and has been investigated using fractures analysis techniques on SEM (JEOL T 330, 20 KV), with EDS. Precipitates large size have been mentioned as responsible for these cracks (2-3).

RESULTS AND DISCUSSION

AISI 409 ferritic stainless welded tubes samples present as chemical composition:
%C 0,015 ; %Mn 0,12; %Si 0,35; %Cr 11,59; %Ti 0,14; %Nb 0,10.

Samples showing longitudinal cracks have been investigated. First of all, surfaces were separated and submitted to ultrasonic cleanness. Cracks observed on SEM, have reveled cleavage mechanism, typical from brittle fractures, and mainly chevron marks pointing to the origin of fracture. Figure 1 (a) presents area pointed as failure initial region, figure 1 (b) shows in detail particle which is responsible for cracking mechanism in the welded zone. Arrow indicates the 20 μm precipitate and figure 2 EDS from that precipitate.

CONCLUSION

- Ca rich particles can be responsible for cracking developments on AISI 409 welded tubes. They appeared as exogenous inclusions, 15 a 20 μm size.
- Fracture analysis techniques lead to those precipitates as responsible for cleavage mechanism.

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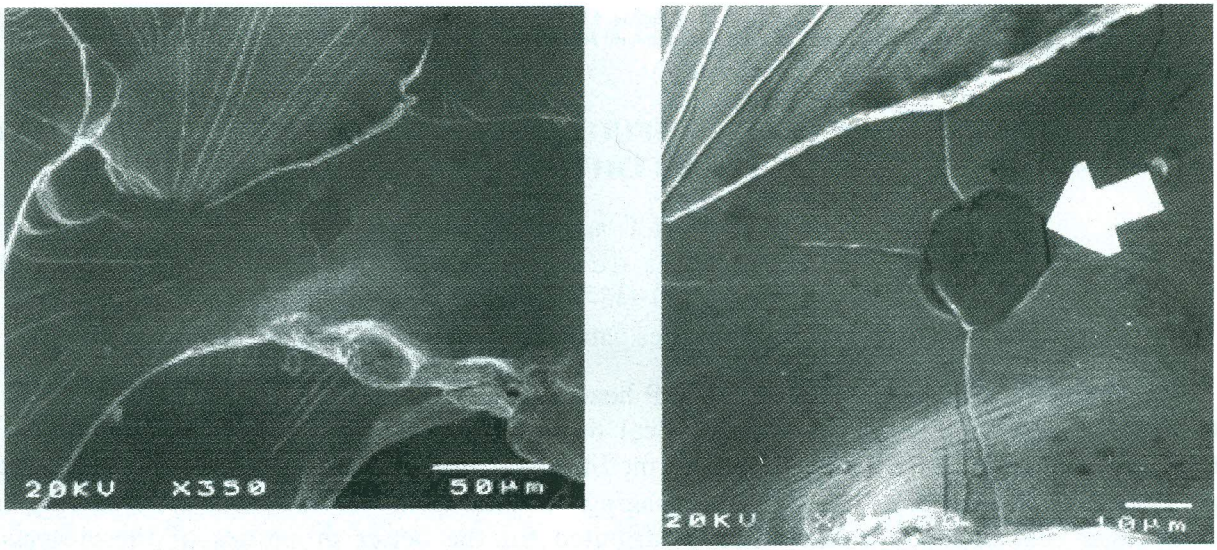

Figure 1: (a) SEM image, initial crack area., (b) arrow pointing to particle responsible for cleavage mechanism development. Precipitate about 20 µm large.

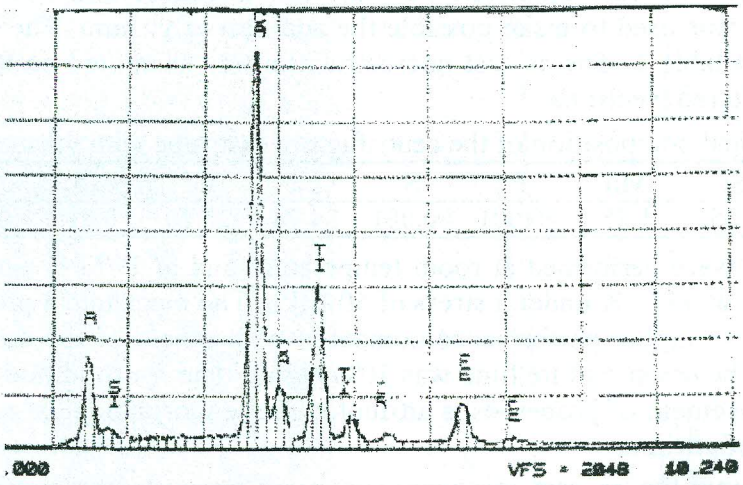

Figure 2: Particle (arrow figure 1.(b)) EDS analysis. Ca rich particle.