

FRACTURE MECHANICAL VALUES OF MODERN PIPELINE-STEELS

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ABSTRACT

This paper deals with the determination of CTOD- (Crack Tip Opening Displacement-) values according to BS 7448 using three point bend specimens and CA (Crack-Arrest Fracture-Toughness) values using three-point bend specimens (test proposal of TVFA), compact-crack-arrest specimens (ASTM E 1221), and full-thickness compact-crack-arrest specimens (test proposal of Crosley and Ripling). The problems in determining the crack tip opening displacement and crack-arrest fracture-toughness are discussed in detail, the results are compared. Finally the different resulting fracture mechanical values, as for example CTOD (Crack Tip Opening Displacement) values and CA (Crack-Arrest) values etc., of the welds (welding metals and heat affected zones) are compared with each other and with the values of the base material.

The tested materials were the base material, the weld metal, and the heat affected zone of welds, using different welding processes, as Shielded Metal Arc Welding, Gas Metal Arc Welding, or Submerged Arc Welding, of the pipeline steels X 70 according to API 5L (StE 480.7 TM according to DIN 17 172 or L 485MB according to OENORM EN 10 208 – 2) and X80 according to API 5L (L 555MB according to OENORM EN 10 208 – 2) and the duplex-steel 1.4462 according to DIN 17 440, DIN 17 441, SEW 400, OENORM EN 10 088, part 1 to 3, and TÜV-Austria (1.4462 according to OENORM EN 10 027 – 2, X 2 CrNiMoN 22 5 3 according to OENORM EN 10 027 – 1 or S31803 according to ASTM UNS).

BENEFITS

Overview about the variations of the fracture mechanical values (CTOD and CA) of the pipeline-steels X70, X80, and the duplex-steel 1.4462 according to different standards or test proposals. Comparison of the values for the base material, the weld metal, and the heat affected zone of welds according to different welding processes.

KEY WORDS

Fracture mechanical values, CTOD (Crack Tip Opening Displacement), CA (Crack-Arrest Fracture Toughness), BS 7448, ASTM E 1221, three-point bend specimens, compact-crack-arrest specimens, full-thickness compact-crack-arrest specimens, pipeline-steels, X70, X80, duplex-steel, 1.4462, base material, weld metal, heat affected zone, different welding processes.