Penerapan metode slow strain rate tensile cracking test (SSRTCT) dalam karakterisasi kerusakan akibat hydrogen embrittlement pada baja karbon tinggi

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Abstrak

Hydrogen Embrittlement (HE) is one of fracture types which may be occurred on various materials including steel. Such fracture type may accelerate degradation of material properties from ductile to brittle. This paper describes the research result of such fracture on high carbon steel by using Slow Strain Rate Tensile Cracking -Test (SSRTCT). The parameters consist of cathodically current density, strain rate which corelated with ductility, fracture elongation, strength, ratio of fracture energy (RSc), and fracture time.

The trial result indicated that increasing cathodically current density would considerably reduce material ductility due to Hydrogen Embrittlement (HE), therefore it would accelerate fracture.Whereas the slower strain rate would decrease material ductility but fracture time was slower. The fracture due to Hydrogen Embrittlement (HE) reached maximum or steady state when cathodically current density was higher , i _> 50 p A/cm2 , and strain rate was too slow ,c' S 10-6 per second. On the other hand , high carbon steel was resistant relatively from Hydrogen Embrittlement (HE) in very low cathodically current density, is _<10 p.A/cm2, as same as, in fastly strain rate , s'>1O per second. Fractographical appearance shew that material fractured due to HE , was observed mainly intergranular structure . Whereas material without HE was observed mainly dimple structure.
<hr>Hydrogen Embrittlement (HE) merupakan salah satu jenis kerusakan yang dapat terjadi pada berbagai jenis material termasuk baja. Jenis kerusakan itu dapat mempercepat penurunan sifat material yang semula ulet menjadi getas. Makalah ini membahas hasil penelitian jenis kerusakan HE tersebut pada baja karbon tinggi dengan menggunakan Slow Strain Rate Tensile Cracking Test (SSRTCT). Parameter yang diteliti terdiri atas rapat arus katodik, dan laju regangan terhadap keuletan, elongasi , kekuatan, rasio energi patah (RSc) dan waktu patah.

Hasil percobaan menunjukkan peningkatan arus katodik menurunkan keuletan material akibat Hydrogen Embrittlement (HE) sehingga mempercepat perpatahan. Sedangkan makin lambat laju regang akan menurunkan keuletan material tetapi waktu perpatahan semakin lambat. Kerusakan Hydrogen Embrittlement (HE) mencapai maksimum atau kondisi jenuh pada rapat arus katodik yang besar i _> 50 µA/cm2 dan laju regang yang sangat lambat a' _< 10'6 per detik. Sebaliknya baja karbon tinggi relatif tahan terhadap Hydrogen Embrittlement (HE) pada rapat arus katodik yang rendah i_<10 pA/cm2 dan laju regang yang sangat cepat, E'>10-6 per detik. Penampakan fraktografi menunjukkan material yang mengalami kerusakan HE membentuk struktur dominan intergranular sedangkan material yang tidak mengalami kerusakan HE membentuk struktur dominan berserat-serat (dimple).