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Cyclic Plastic Deformation of 20MN-MO-NI 55 Steel in Dynamic Strain Ageing Regime

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Abstract : Low cycle fatigue behavior of a ferritic, martensitic pressure vessel steel at dynamic strain ageing regime of 250°C to 280°C has been investigated. Dynamic strain ageing is a mechanism that has attracted interests of researchers due to its fascinating inexplicable repetitive nature for quite a long time. The interaction of dynamic strain ageing and cyclic plasticity has been studied from the mechanistic point of view. Dynamic strain ageing gives rise to identical serrated flow behavior in tensile and compressive halves of hysteresis loops and this has been found to gives rise to initial cyclic hardening followed by softening behavior, where as in non-DSA regime continuous cyclic softening has been found to be the dominant mechanism. An appreciable sensitivity towards nature of serrations has been observed due to degree of hardening of stable loop. The increase in degree of hardening with strain amplitude in the regime where only A type serrations are present and it decreases with strain amplitude where A+B type of serrations are present. Masing type of locus has been found in the behavior of metal at 280°C. Cyclic Stress Strain curve and Master curve has been constructed to decipher among the fatigue strength and ductility coefficients. Fractographic examinations have also shown a competition between progression of striations and secondary cracking.

Keywords : dynamic strain ageing, hardening, low cycle fatigue, softening
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