

(649) Strain Controlled Fretting Fatigue Test

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1. Introduction: Fretting fatigue tests are usually performed under load controlled conditions, in which the slip amplitude at the fretting site varies due to change in strain, and so the boundaries of the fretting action are not constant. Under strain controlled conditions the slip amplitude remains constant as it is directly dependent on the strain. Thus, using strain controlled tests it may be possible to establish the positions of high stress concentrations produced by fretting and thus clarify the basic mechanisms. This reports preliminary results on the feasibility of using strain controlled tests in this field.

2. Investigation Procedures: The material being used is S45C steel in the as received condition. The specimen and fretting bridges configurations are shown in Fig.1. The fretting action is produced during the test by clamping the bridges to the specimen using a proving ring as shown. The tests are being done on an MTS servo-hydraulic testing machine. A 25mm gauge extensometer is used for strain control by attaching it to the rounded section of the specimen gauge length.

3. Initial Results: Initial results in low cycle tests (Fig.2) have shown that fretting causes a reduction in fatigue life similar to that normally found in load controlled tests. For example, at 0.5% total strain amplitude a 65% reduction in fatigue life was found. Fig.3 shows micrographs of the edges of two fretting scars produced in strain controlled and load controlled tests respectively. It can be seen that the strain controlled test produced a definite fretting scar boundary whereas the load controlled scar is more diffuse.

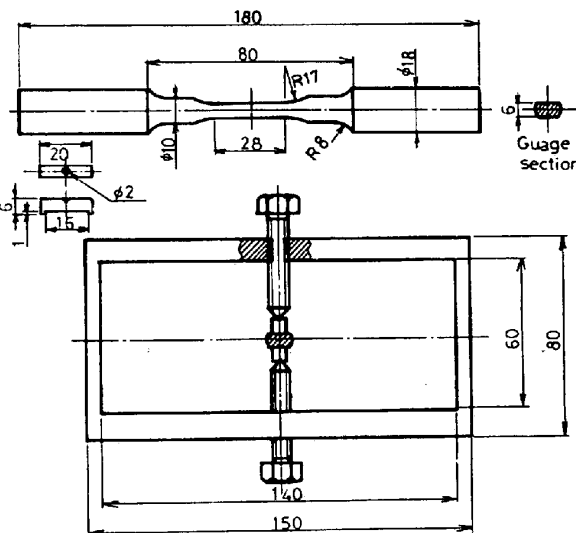


Fig.1. Specimen design and proving ring arrangement.

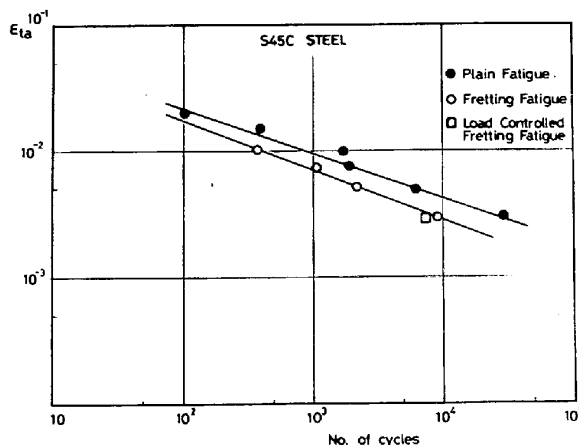


Fig.2. Total strain amplitude (ϵ_{ta}) vs number of cycles to failure.

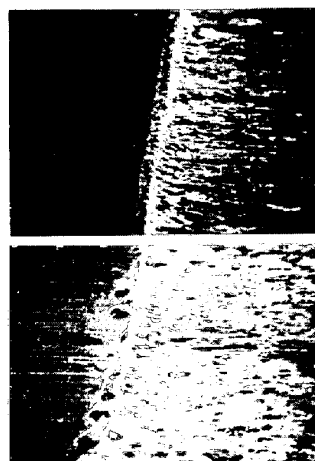


Fig.3.

- (a) Edge of a fretting scar from a strain controlled test.
- (b) Edge of a car fretting scar from a load controlled test.