HIGH FREQUENCY - CRACKTRONIC - MACHINE FOR MAKING FATIGUE CRACKS ON NOTCHED BAR IMAPCT TEST

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INTRODUCTION

The aim of this short presentation was to call your attention on choosing appropriate methods for fatiguing notched bar impact test pieces and to show a new, efficient, small but handy apparatus together with its application possibilities in the fields of fracture mechanics and material fatigue.

RESULTS AND DISCUSSION

In order to define the dynamic stress intensity factor a specially prepared test piece is needed. This speciality refers to preparation of the dynamic crack of a defined depth. Conditions under which this crack should be obtained together with demands which should be met by the test piece itself in order to guarantee reproducable results of examination are stated in the recommendations (1, 2) to the standard.

The recommendation (1) contains all conditions for test piece preparation as well as for testing on the instrumented Charpy machine. After analysing these standards it becomes obvions that the way of sample fatigue is not determined. It means that neither the three-point, not the four-point obending fatigue nor fatigue by mere moment are particularly demanded.

In our work (3) fatigue on hundreds of notch-bar impact test pieces was carried out in order to obtain dynamic cracks. However we did not consider any possible phenomenon - like influence of ligaments of the dynamic stress intensity factor and on material toughness respectively.

To get a dynamic crack of a definite length by fatigue test, stress is imposed on the compressive sample part which - depending on size of the force - more or less strain hardens the material. This strain hardening depends on the size of the force and the duration of the fatigue cycle. It means that there is a dynamic crack in the sample with a ligament consisting of a sound undamaged sample section and a section damaged by strain hardening (see Fig. 1A). Therefore their is a brittle component in the fracture character.

The dependance of the damaged layer on the size of the load P is shown by isochromatic - fringe pattern in Fig. 1B (a. $P = 0$; b. $P1$; c. $P2 > P1$). This brittle part in the load - deflection curves in

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instrumented Charpy investigation is manifasted in the amount of residual energy and in the size of stopping force, resprectively.

By the new high frequency CRACKTRONIC fatigue machine of the firm RUSSENBERGER PRUEFMASCHINEN AG, Schaffhausen Switzerland the samples are tested on the principle of mere moment. Isochromatic - fringe pattern (Fig. 1C) have been made for this fatigue principle for different levels of moment M (a. M = Ø; b. M 1; c. M 2 > M 1).

It can be seen that on the side opposite to cracks there is only compressive stress and that there are no concentrations due to acting of the concentrated load P. The residual ligament possesses a far larger undamaged section which should result in a more favourable character with respect to the portion of tough component at fracture in a test piece with the same dynamic crack depth.

Fig. 2 is a schematic presentation the high frequency fatigue CRACKTRONIC machine together with possible attachments for handling and evaluation (4).

REFERENCE

(1) ASTM E 24.03.03.

(2) MAN, J., HOLZMANN, H. and VLAH, B.: Arbeitsmaterial zur RGW Thema 22 K.03, Dokument 06. C - 12 UFM - 6 - 85.

(3) DOBI, Đ.: Ph. D. Thesis in Preparation.

(4) BERCHTOLD, R., SCHEFFEL, R. and STUENKEL, R.: "Automatiesierte Versuchsfuerung zur Ermitlung der Rissausbreitung bei unterschiedlichen Bedingungen", DVM Werkstoffpruefung, Bad Nauheim, 27 bis 28 November 1986.

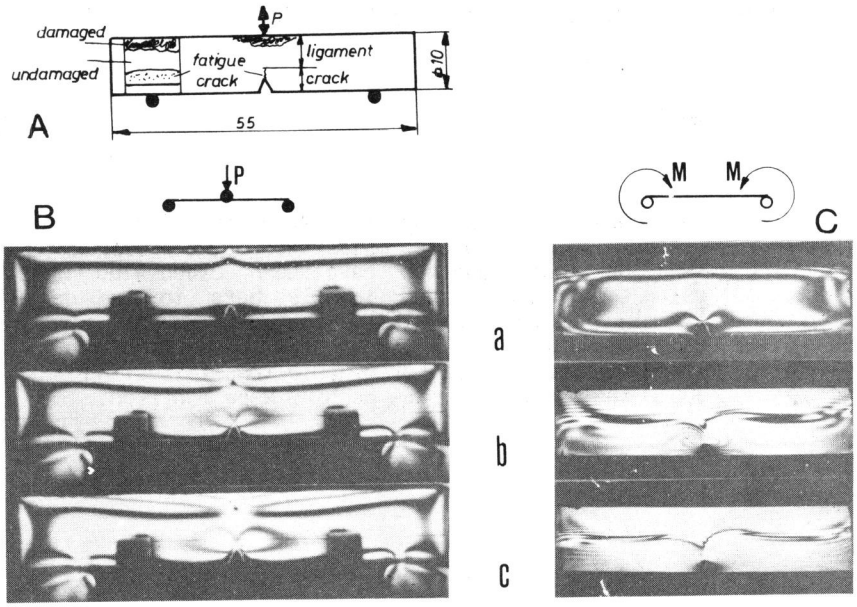

Fig. 1 Isochromatic fringe patters

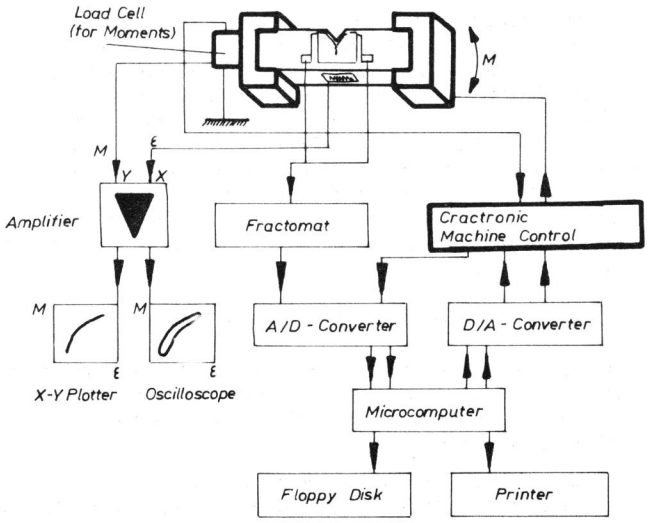

Fig. 2 High frequency fatigue CRACKTRONIC machine