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

Dorde DOBI * and Roland BERCHTOLD **

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 to-
gether with its application possibilities in the fields of frac-
ture 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 prepara-
tion 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 re-
producible results of examination are stated in the recommenda-
tions (1, 2) to the standard.

The recommendation (1) contains all conditions for test piece pre-
paration as well as for testing on the instrumented Charpy machine.
After analysing these standards it becomes obvious 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 mo-
ment are particularly demanded.

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

To get a dynamic crack of a definite length by fatigue test, stress
is imposed on the compressive sample part which - depending on si-
ze 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 = G; b. P1;
c. P2 > P1). This brittle part in the load - deflection curves in

* - Steelwork Ravne, Ravne, Yugoslavia
** - Russenberger Prüfmaschinen AG, Schaffhausen, Switzerland

P 130.1 721
instrumented Charpy investigation is manifested in the amount of residual energy and in the size of stopping force, respectively.

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 = 0; 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, R.: Arbeitsmaterial zur RGW Thema 22 K.03, Dokument 06. C - 12 UFM - 6 - 85.


Fig. 1 Isochromatic fringe patterns

Fig. 2 High frequency fatigue CRACKTRONIC machine