Testing and Analysis

Fatigue and Crack Growth in Engineering Plastics

Introduction

Based on the work of Wyzgoski and Novak, Axel Products is developing automated test systems and methods for the measurement of crack growth in structural plastics under static and fatigue loadings. The overall objective of this effort is to use fatigue crack growth experimental data to effectively expand traditional single condition s-n fatigue data to a data set containing multiple temperatures and rates.

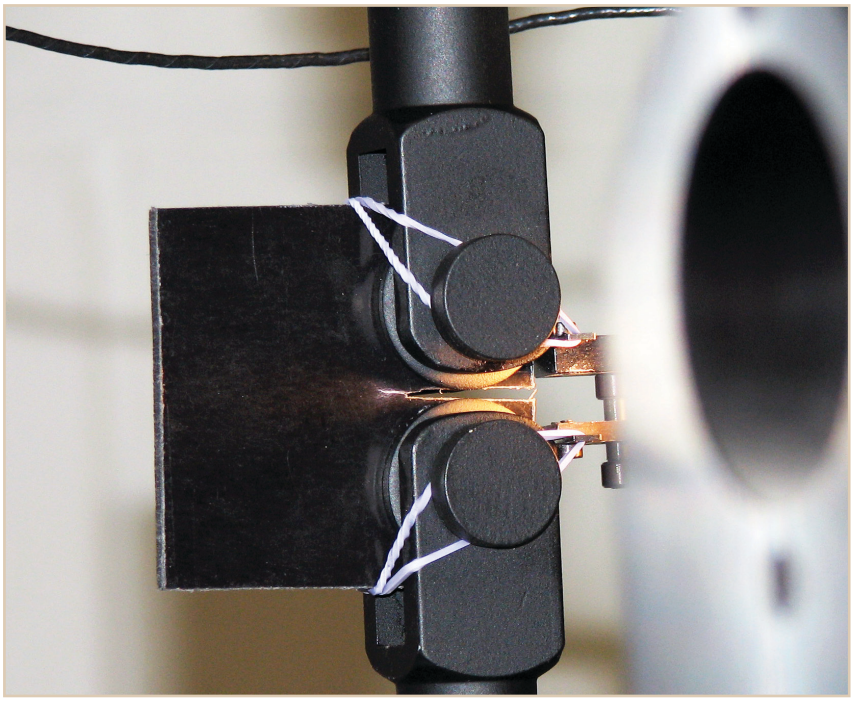

Figure 1, Plastic compact tension specimen in a fatigue crack growth experiment.

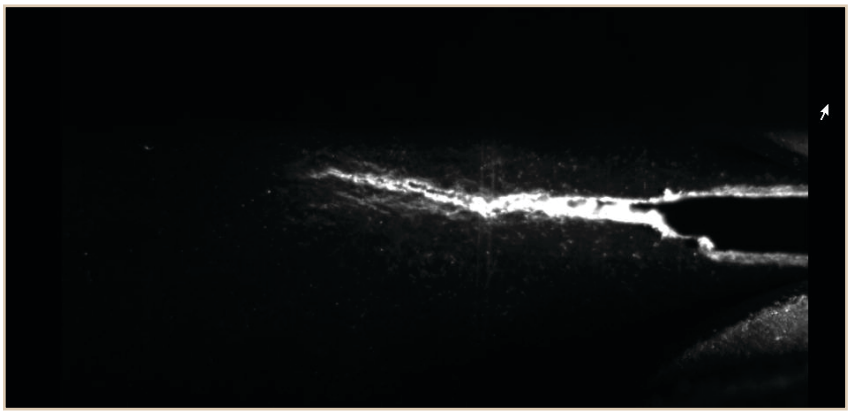

Figure 2, Crack image during a fatigue crack growth experiment. The crack and the damage field around the crack is visible.

The Fatigue Crack Growth Experiment

A compact tension test specimen is pre-cracked and loaded with a constant force controlled sine wave. The compliance of the test specimen is captured with a clip-on extensometer. The crack size is measured using a camera system and customized software which extracts the crack dimentions from an image.

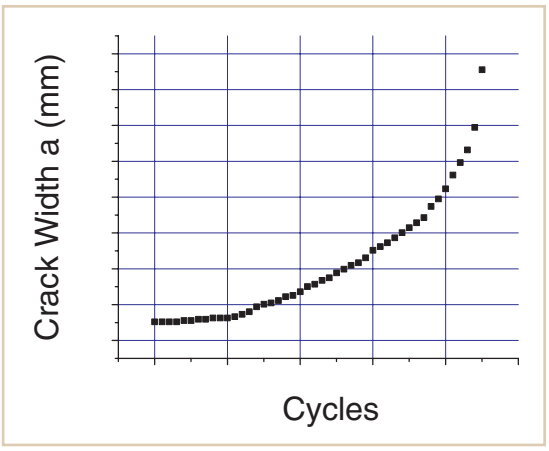

Figure 3, Crack size measurements as a function of fatigue cycles.

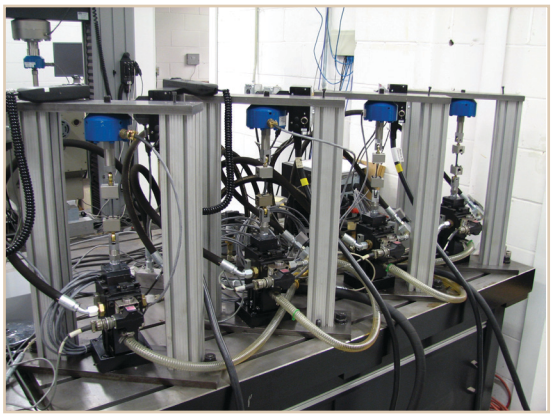

Figure 4, Servo-hydraulic fatigue frames performing classic load controlled fatigue tests on tension speciemns..

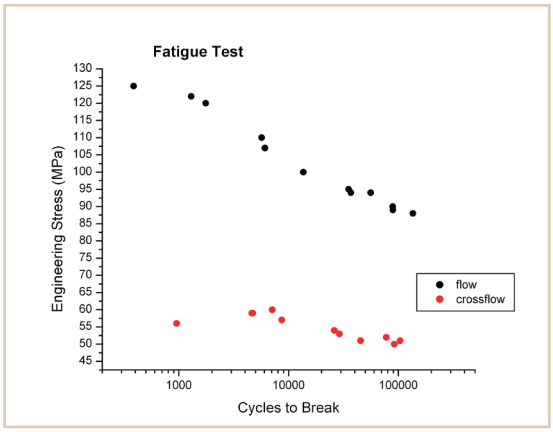

Figure 5, Classic s-n fatigue test data.

References:

1. M. G. WYZGOSKI, G. E. NOVAK, “Predicting fatigue S-N (stress-number of cycles to fail) behavior of reinforced plastics using fracture mechanics theory” JOURNAL OF MATERIALS SCIENCE 40 (2005) 295– 308

2. M. G. WYZGOSKI, G. E. NOVAK, “Fatigue fracture of nylon polymers Part 1 Effect of frequency” JOURNAL OF MATERIALS SCIENCE 25 (1990) 4501-4510

For more information, visit www.axelproducts.com.

Axel Products provides physical testing services for engineers and analysts. The focus is on the characterization of nonlinear materials such as elastomers and plastics.

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