Introduction

This, the third symposium sponsored by Subcommittee II on Fractography and Associated Microstructures of ASTM Committee E-24 on Fracture Testing of Metals, was designed to reflect current activities in the field of electron microfractography and their relevance to the study of the mechanical and physical properties of materials. The papers included in this volume represent, in part, the results of Subcommittee Task Group activities and, in part, the efforts of individuals working independently. They cover a wide spectrum of topics ranging from the quantitative correlation of fractographically observed features with mechanical properties of materials to the direct study of the mechanical failure of bonded composite structures in the scanning electron microscope.

The report of the first Task Group, under the direction of A. J. Brothers, lists quantitative information indicating that the width of the stretched zone that precedes rapid fracture, located at the tip of the fatigue crack on the fracture surface of maraging steel, aluminum, and titanium alloy fracture-toughness specimens, increases with increasing fracture toughness. The paper presented by the second Task Group, under F. L. Carr, correlates the fibrous and radial macrofractographic features with the microfractographic features observed on the fracture surfaces of AISI 4340 steel. The effects of strength level and testing temperature on the fracture surface topography also have been studied.

The detailed qualitative study by U. E. Wolff, of the fracture surface of an aluminum alloy fracture toughness specimen precracked by fatigue, suggests that, in general, the stretched zones on the two mating fracture surfaces appear in the form of a V, the apex of which represents the onset of ductile fracture.

The paper by C. D. Bailey is an example of the direct application of the scanning electron microscope to an engineering problem involving the fracture of a composite honeycomb structure. Porosity of the adhesive film, corrosion of the aluminum honeycomb cells, and the lack of chemical bond between the core and the adhesive were observations made with this instrument.

The examination of brittle fracture surfaces to study high-temperature phenomena by K. Farrell and J. O. Stiegler elicited information concerning the shapes, crystallography, and the growth of gas bubbles on the grain boundaries of chemically vapor deposited tungsten. Studies also were made of the shapes and behavior of creep cavities in tungsten produced by the techniques of powder metallurgy. The examination of the distribution of welding porosity in fusion welds in tungsten completed this study of high-temperature processes.

Microstructural and fractographic correlative studies to investigate the factors contributing to variations in hot ductility with variations in test temperatures, at high strain rates, were carried out by J. H. Bucher and G. A. Wilber. The operative fracture mechanisms under conditions of high temperature were identified, and an assessment was made of the effects of inclusions, precipitates, and second phase particles on the mechanical properties of several alloys.

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