# Nondestructive Monitoring of Materials Properties

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# Nondestructive Monitoring of Materials Properties

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# Preface

The nondestructive monitoring of materials properties is a rapidly growing research area which faces the unique challenge of providing nondestructive, and preferably noninvasive, techniques and methodologies for assessing microstructure, morphology, physical properties, mechanical properties, etc., in the industrial environment from the early stages of materials processing and design to the final phases of a component's life.

Applications of these techniques, which at present are still largely in the early stages of laboratory development, range from process development and process control to assessment and extension of the useful life of existing structures.

The present volume contains the edited papers of the first MRS symposium devoted entirely to this area, and is certainly manifestation of the explosive growth of nondestructive evaluation in recent years and the extraordinary capacity for integration and increase of scope of Materials Science and Engineering. The symposium was held during the MRS Fall Meeting, Boston, November 28 - December 3, 1988. Sponsorship of the symposium was provided by the Electric Power Research Institute, the International Center for Diffraction Data, Battelle, and the Industrial Materials Research Institute of the National Research Council Canada.

In organizing the papers in this highly multidisciplinary area, one is always faced with the difficult choice between emphasizing techniques, materials, or the type of property to be measured. The major headings of these proceedings represent an eclectic--we hope--mixture of all these.

The first section, "Overview and New Techniques," reflects the concern for improving and making available new techniques for probing materials nondestructively, with applications ranging from microelectronics to steel processing. As described in the first paper, the availability of nondestructive evaluation tools for materials and flaw characterization is an important element for the realization of new concepts such as "materials by design" and "unified life cycle engineering," where they will serve not only process and quality control but will be totally integrated, even at the design phase of manufacturing.

The next section, on "degradation monitoring," is one of the focal areas of the symposium in response to rapidly growing interest, especially in the utilities industries, in extending the life of existing structures. Papers describe the use of ultrasonic, electromagnetic, NMR, microradiography and position annihilation techniques for monitoring damage due to creep, fatigue, hydrogen, and other environmental influences, primarily in metallic structures.

Monitoring of "texture and stress," using x-ray and neutron diffraction and ultrasonic velocity measurements for process evaluation and process control is the main theme of the next section.

The remaining sections are devoted to "polymers and composites," "ceramics" and "metals and metallic bonded structures," reflecting considerable interest in improving processing and quality control in those rapidly growing areas.

The editors are grateful to G. Cyr, Charlotte Roseberry, and Virginia Miller for participating in the organization of the symposium and in the preparation of the proceedings.

John Holbrook
Jean Bussière

August 1989

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