# Introduction

At the previous ASTM Symposium on X-ray and Electron Probe Analysis (STP 349) in 1963 only token mention was made of the possibility of energy dispersion X-ray analysis. The development of the wavelength disperson crystal diffraction spectrometer and of special crystals for it has continued over the past several decades to the point where very highly refined instruments are commercially available. The history of the energy dispersion X-ray spectrometer is much more recent.

The first application of this device to the electron microprobe was reported by two of the authors of papers in this volume (Fitzgerald and Heinrich) in 1968 and the first application to the scanning electron microscope by another author (Russ) shortly thereafter. At this time the performance of the energy dispersion X-ray analyzer was barely adequate to separate adjacent heavy elements and to identify elements down to about atomic number 15.

The companies manufacturing semiconductor detectors and electronics and the national laboratories have made great strides in development within the past few years. The past concentration on application of these instruments in nuclear physics have given way with the realization that a substantial market is available in X-ray analysis for industry and research. Development of systems optimized for the particular requirements of X-ray analysis has proceeded very rapidly; at its present state of art the energy dispersion X-ray analyzer is competitive in many respects with the older wavelength dispersion spectrometer. It is likely that the energy dispersion X-ray analyzer will replace the older wavelength dispersion spectrometer in many, perhaps most, of its applications within the next few years. The papers in this volume discuss, in detail, the relative merits and disadvantages of the two techniques.

Because of the rapid developments in this field there has been no comprehensive literature available. Accordingly, Subcommittee 15 on Microprobe Analysis of ASTM Committee E-4 on Metallography has sponsored the symposium represented by the papers in this volume. The intention was to provide a description of the internal workings of these devices so that the user could understand the design choices that had been made and their importance for X-ray analysis, and to summarize the capabilities and areas of applications of the instruments as a guide to new workers in the field.

One of the first problems the committee had was deciding on the name of the symposium. These detectors have been variously called nondis-

persive, nondiffractive, solid state or semiconductor, and energy dispersion X-ray analyzers. We rejected the first one because it is both technically incorrect and conveys no information and the second because it did not describe to the user the workings of the device. The third and fourth conveyed meaning only to the manufacturers, not users. The last is technically acceptable and moreover identifies the significant variable by which the X-rays are classified. Therefore we have chosen the name Energy Dispersion X-ray Analysis and hope that the publication of this book with that title will help to simplify and standardize the terminology in the future.

The meeting held in Toronto in June of 1970 was attended by over 200 people and included twelve of the papers in this volume. The papers were invited from the outstanding workers in the field to cover specific topics and present a complete picture of the equipment, capabilities, and techniques of energy dispersion X-ray analysis, especially in comparison to the older, better known wavelength dispersion spectrometers. The first six papers discuss the design of various parts of the system and the ways in which design choices influence results. The last seven papers describe the particular applications of these analyzers to various instruments and the interpretation of the resulting data. All of the papers were reviewed, and one additional paper on light element analysis was written after the symposium, to take advantage of the extensive discussion that took place at the meeting between the attendees and the authors. It is hoped that this volume will become an important reference volume in a very exciting and rapidly growing field.

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