Applications of Low Energy and Gamma Rays

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Reviewer	Frederick D. Seward

This book is a collection of symposium papers. The title is an excellent description of the contents. Virtually all articles are aimed at a particular application and the specific problems which must be solved to get workable systems. The photon energy range covered is about 1 to 100 keV.

The book is divided into four sections titled: Industrial Applications; Geological Applications; Bio-Medical Applications; and X- and Gamma Ray Techniques. Most of the papers are concerned with x-ray fluorescence analysis. By generating fluorescent x rays the relative amounts of particular elements contained in other materials can be measured. The thickness of a layer can be rapidly determined by transmission measurements. A few papers are concerned with gamma and x rays given off when materials are bombarded with electrons or neutrons. The use of the Mossbauer effect to determine chemical states is also covered.

The subject material is well balanced. There are industrial applications concerning rapid assembly-line inspection of material. There are papers concerning pollution, for example, detection of sulfur dioxide in stack gases, and detection of lead paint on painted surfaces. The analysis of moon rocks and medical applications are included.

The papers contain descriptions of detectors—proportional counters, scintillation counters, and solid state detectors—and discuss the use of filters to emphasize the detection of fluorescent x rays from particular materials. There are several descriptions of radioactive sources used for fluorescent x-ray excitation and the optimum geometry for the source, target, and detector. The analysis of x-ray-fluorescence data is treated in detail. Some techniques require the use of a small computer for rapid assessment of results. Most articles are illustrated with spectra from the x-ray detector used, and the criteria used in searching for particular elements are discussed.

This is not a book to interest pure physics students. The underlying principles are usually not covered. The papers concern applications and the practical problems which arise when developing a particular technique. Emphasis is definitely on practicality and not pure science. Some of the papers contain tables and graphs which might be valuable as source material to those concerned with that particular application.

The book is well put together, and there are many illustrations. Most of the articles are rather short and to the point. I found the articles concerning application of the Mossbauer effect difficult to understand; a few paragraphs of general discussion and less detail would have been an improvement. Occasionally important points are omitted. One article concerned the detection of particular materials in the human system by irradiating the patient with x rays. In no place was the x-ray dose the patient received mentioned. The book also left me with another puzzle. On the paper jacket there is a picture of a serious young man holding an instrument against a telephone pole and looking rather apprehensive. I could not find an explanation of what this fellow was doing.

On the whole, this book is interesting and should broaden the knowledge of the reader. Others working with x rays will find it worth their time to read.

Frederick D. Seward (AB, Princeton University, 1953, PhD, physics, University of Rochester, 1958) is a group leader at the Lawrence Livermore Laboratory. His group specializes in building sensitive x-ray detectors for sounding rockets and has made numerous observations of x-rays from cosmic sources in the energy range from 0.1 to 50 keV. The group has measured the x-ray spectra of the brighter sources in the sky and has specialized in observations below 1-keV photon energy. Before x-ray astronomy Seward did experiments in low-energy nuclear reactions and photonuclear reactions, and was a consultant for the Vela Satellite Program.