

Preface

Spectrochemical analysis is a powerful instrumental principle for the determination of the chemical elements and their species in a variety of sample types of different size, at widely different concentration levels, and with very differing cost–performance ratios and time consumption. In addition, not only monoelement but also multielement determinations are possible, with widely differing precision and accuracy, using the various different methods. The basic principles of spectrochemical analysis are related to atomic and molecular structure and also to gas-discharge physics as well as to instrumentation and measurement sciences. Therefore, research into spectrochemical analysis requires knowledge of the aforementioned disciplines to enable innovative developments of new methodologies to be achieved in terms of the improvement of power of detection, accuracy, and cost–performance ratios, these being the driving forces in analytical innovation. The development of analytical procedures also requires the analytical chemist to have a knowledge of the theory and the principles of the above-mentioned disciplines. It is the aim of this monograph to bring together the theory and principles of today's spectrochemical methods that make use of flames and plasma sources. This should enable researchers to enter the field of spectrochemical research, where innovation is through the use and development of new sources and the application of new types of spectrometers, and also to face challenges from emerging fields of application, which is as straightforward today as it was even in the time of Bunsen and Kirchhoff. This work should appeal both to chemists and physicists, the cooperation of whom is instrumental for progress to be made in this field of analytical chemistry, as well as to users from different areas of science, including the life sciences, material sciences, environmental sciences, geochemistry, chemical process technology, etc. The present work could also be viewed as a résumé of the theoretical background, which manufacturers of instrumentation for atomic absorption spectrometry, arc, spark and glow discharge emission spectrometry, as well as ICP emission spectrometry and plasma mass spectrometry with ICPs or glow discharges and laser-based techniques can recommend to their interested users to make the most efficient use of these analytical methods in their respective fields of application. Also, research associates entering the field of atomic spectroscopy with flames and plasmas should find the necessary basics and references to further literature in this book.

The work also describes a number of achievements of over thirty years of research performed at the University of Gent (Belgium), the Institute for Analytical Sciences – ISAS Dortmund, the University of Dortmund, the University of Leipzig, and the University of Hamburg, which have been made possible through many interactions and collaborations with experts in the field, whom I thank thoroughly. A great deal of knowledge gained from my teachers and in interaction with prominent senior researchers in the field worldwide and especially at the Council for Scientific and Industrial Research and the University of Stellenbosch (South Africa), the Universitaire Instelling Antwerpen (UIA) (Belgium), and Indiana University, Bloomington (IN, USA), as well as results obtained while collaborating with colleagues and with students, made this book possible, for which all of them are gratefully acknowledged and thanked.

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