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Spectrochemical Emission and X-Ray Analysis (Including some remarks on Mass Spectrometric Analysis of Solids)

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SPECTROCHEMICAL EMISSION AND X-RAY ANALYSIS (INCLUDING SOME REMARKS ON MASS SPECTROMETRIC ANALYSIS OF SOLIDS)

INTRODUCTION

The two analytical techniques mentioned in the title have the same physical basis. The characteristic radiation which is produced by the atoms of a particular element is used as an analytical signal to detect this element, to distinguish it from other elements and to determine its concentration or its quantity in a sample to be analysed. Detection and identification requires wavelength-measurements. Quantitative determination requires intensity-measurements. In mass spectrometric analysis the analytical signals are not given by the characteristic radiation of the atoms, but by the characteristic masses. But this apart, the field of application and many problems in the measuring technique are the same as in emission spectrochemical analysis. A glimpse at this new field of analysis will be given later.

THE UNIVERSALITY OF EMISSION SPECTROCHEMICAL ANALYSIS The characteristic feature of the three branches of chemical analysis which will be the object of this review, is their universality. They are used for the detection and determination of practically all chemical elements. These can be detected simultaneously. Furthermore there is practically no restriction as to the nature of the substance to be analysed. Materials of any kind can be analysed if some simple mechanical or chemical sample preparation is included. In particular for emission spectroscopic analysis it can be stated that there is no other analytical principle which can be adapted to so many different analytical problems and which has an information capacity of which only a part can actually be used for analytical work. This is so because the characteristic radiation, the spectrum of an element is determined by the structure of the atom, in particular by the shell of electrons and this same atomic structure is responsible for the chemical properties of the element. Therefore, in spectrochemical analysis the analytical signal has not the character of circumstantial evidence but is directly correlated to the chemical nature of the elements. This explains the universality, the widespread use and the present drive in spectrochemical analysis. But, of course, the direct link between analytical signal and chemical element should not imply that such an analytical principle will always yield the best solution for any analytical problem. This obviously would be nonsense, since many other practical and economical circumstances have to be considered in making a choice how to solve an analytical problem.

ANALYTICAL PRINCIPLE VERSUS ANALYTICAL METHOD It may be useful for a relatively short general survey to work out the difference between an analytical principle and a definite analytical method based upon

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