RARE EARTHS SPECTROSCOPY

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on Rare Earths Spectroscopy
Wrocław, Poland, September 10-15, 1984.

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PREFACE

The International Symposium "Rare Earths Spectroscopy" was held in Wrocław, Poland, September 10-15, 1984.

The Symposium was addressed to physicists and chemists interested in rare earths spectroscopy. The main aim of the Symposium was the presentation of the new achievements in spectroscopy of RE ions in solution and solid state and possibilities of their applications in the field of laser technology.

The Symposium covered the following areas in rare earth spectroscopy: spectroscopy methods in structural studies of lanthanide compounds, intensities of f-f transitions, f-d transitions, hypersensitivity, environment effects, luminescence, non-radiative transitions, energy transfer and technology of laser and phosphors.

The Symposium was attended by 120 scientists representing Austria, Brazil, China, GDR, England, Finland, France, India, Israel, Hungary, Holland, Poland, Rumania, USA, USSR and Vietnam. The plenary lectures and posters have provided a broad view of what is new in the rare earths spectroscopy and the excellent mixture of theory and experiment made this Symposium a stimulating one.

The warmest gratitude and an appreciation is expressed to all those taking part in the Symposium, who by their valuable and interesting papers and by taking an active part in discussions as well as by their freedness have greatly contributed to the success of the RES Symposium.

The Organizers acknowledge financial support from the Polish Academy of Sciences, the Technical University of Wrocław and University of Wrocław.

Furthermore we thank our colleagues from the Organizing Committee for their efforts, enthusiasm and energy without which this Symposium would not have been successful.

Wrocław, 20th March, 1985

B Jeżowska-Trzebiatowska
J Legendziewicz
W Stręk

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I. Spectroscopy Methods in Structural Study of Lanthanide Compounds

FREE-ION SPECTRA OF INTEREST TO SOLID AND SOLUTION SPECTROSCOPISTS

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A great deal of information is known about the free-ion spectra of the neutral and singly ionized rare earths because of the ease with which these spectra can be produced. Considerably less is known about the doubly and triply ionized rare earths. A discussion of the experimental difficulties, the present state of knowledge, and the predicted information will be given.

1. INTRODUCTION

The first observations of rare earth spectra used arcs and sparks to excite the spectra. These electrical sources excite predominantly the second spectra (II), that is, the first ion (+1). figure 1 is the electrical circuit for such sources. In the 1950's microwave excitation was tried and this type of excitation produced mainly the neutral spectra. These sources are known as electrodeless discharge lamps (EDL). About 70 to 80% of the lines emitted by an electrodeless discharge lamp run at high-atom-density are from the neutral spectrum, however, if run at low-atom-density the spectrum will reduce to less than 50% neutral, the remaining lines are of the first ion. The EDL has other advantages, the material under study is sealed in a quartz tube and has no electrodes and in most cases it is not necessary to have a carrier gas to start the discharge. The element under study is added usually as the iodide or some other high vapor pressure compound. This source is particulary good for work with radioactive elements. A typical lamp has dimensions, 5 mm inside diameter and 25 mm long and pressures $< 10^{-5}$ torr and contains on the order of 50 to 100 micrograms. The EDL will operate in a magnetic field of the order of 30,000 gauss making possible Zeeman studies. A diagram of such an arrangement is shown in figure 2. Another source which requires much larger samples is the hollow cathode. This source dates back to the 1920's. It emits primarily the neutral spectrum but when operated in the pulsed mode can be made to give both the first,

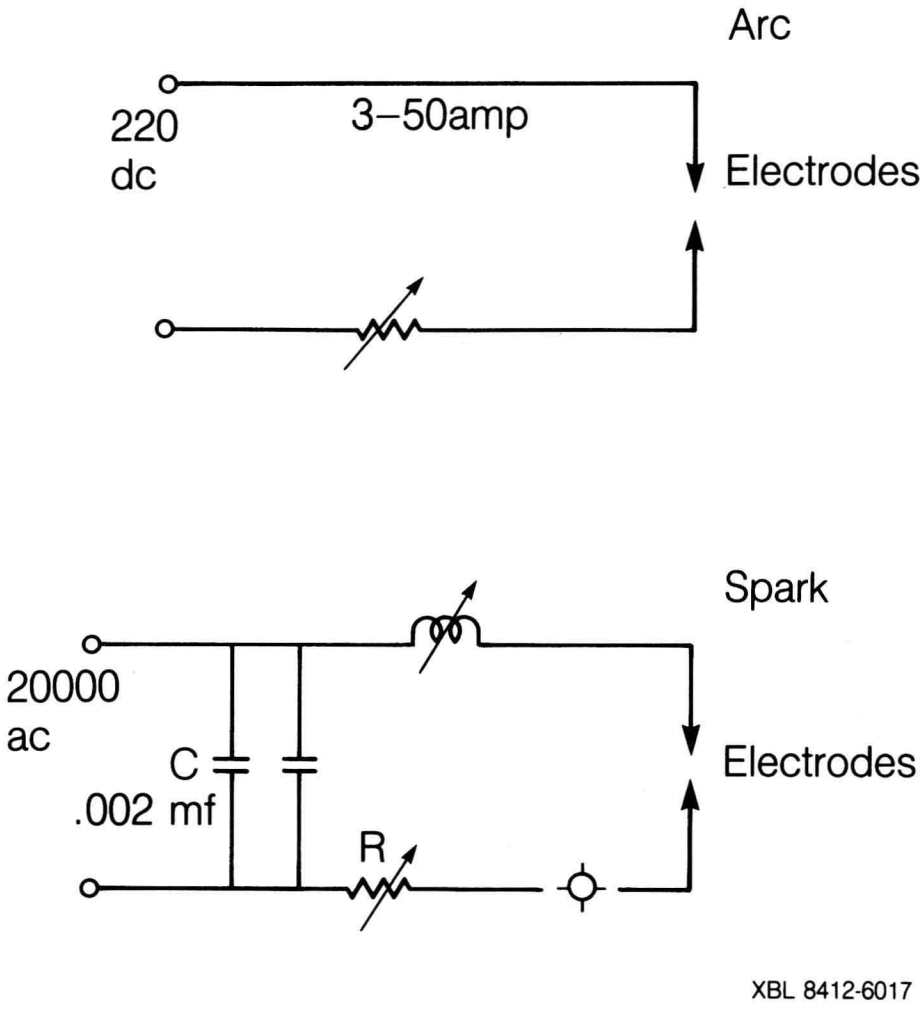

Figure 1: Circuit diagram for a dc arc source and a high frequency spark source.