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23rd Summer School and International Symposium on the Physics of Ionized Gases

August 28th-September 1st 2006, Kopaonik, Serbia

CONTRIBUTED PAPERS

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ABSTRACTS of INVITED LECTURES,
TOPICAL INVITED LECTURES and PROGRESS REPORTS

Editors:

Nenad S. Simonović
Bratislav P. Marinković
Ljupčo Hadžievski

23rd SPIG CONTRIBUTED PAPERS



Institute of Physics
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Belgrade, 2006

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of the
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PREFACE

This book contains the Contributed papers and abstracts of the Invited lectures, Topical invited lectures and Progress reports to be presented at the 23rd Summer School and International Symposium on the Physics of Ionized Gases – SPIG 2006. The symposium will be held in National Park Kopaonik, Serbia, from August 28 to September 1, 2006. The meeting is organized under the auspices and with the support of the Ministry of Science and Environmental Protection, Republic of Serbia. The conference is at the list of European Physical Society (EPS) sponsored conferences.

The Invited lectures and Contributed papers are related to the following research fields: Atomic Collision Processes, Particle and Laser Beam Interaction with Solids, Low Temperature Plasmas and General Plasmas. The length of Contributed papers is limited and each is supposed to present an original work with sufficient amount of scientific information. The Scientific and Organizing Committees believe that this conference manages to maintain the high scientific level of contributed papers and invited speakers in accordance with SPIG's long tradition.

The Editors would like to thank the members of the Scientific and Advisory Committees of SPIG 2006 for their efforts in proposing the invited lectures and progress reports, review of the contributed papers and selection of 12 papers for the oral presentation. We acknowledge the EPS sponsorships granted through East West Task Force scheme. Also, we are grateful for the support of our sponsors Kryooprema d.o.o. and EUnet d.o.o. Especially we acknowledge the support of all members of the Organizing Committee who contributed a lot to the preparing and running of the conference.

The participants have been asked to send their papers camera ready, so no typing, spelling and grammatical errors have been corrected in the course of preparation of this book. The Editors apologize for all mistakes that emerged from the software problems in the process of printing.

Finally we would like to thank all the invited speakers and the participants for taking part in this year's SPIG, to wish them to have a pleasant stay in Kopaonik, and to gain additional momentum and ideas for the future work.

Belgrade, August, 2006

Editors

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SPIG 2006

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 - 1.2. Heavy Particle Collisions
 - 1.3. Swarms and Transport

- Section 2. PARTICLE AND LASER BEAM INTERACTION WITH SOLIDS**
 - 2.1. Atomic Collisions in Solids
 - 2.2. Sputtering and Deposition
 - 2.3. Laser and Plasma Interaction with Surfaces

- Section 3. LOW TEMPERATURE PLASMAS**
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SPIG 2006

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Elastic Electron Scattering by Alanine

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Abstract. We report preliminary results for elastic scattering of electrons by sublimated amino acid alanine. The relative elastic differential cross sections (DCSS) have been measured at 20eV to 80eV electron impact energies (E_0) and within scattering angles from 10° to 150° .

Keywords: Elastic differential cross section, alanine, radiation damage.

PACS: 34.80.Dp

INTRODUCTION

Building blocks of proteins and peptides are amino acids and they all have two characteristic groups: amino group ($-\text{NH}_2$) and carboxyl group ($-\text{COOH}$). The simplest amino acid is glycine ($\text{H}_2\text{N}-\text{CH}_2-\text{COOH}$) and the second-smallest is alanine ($\text{CH}_3-\text{CH}(\text{NH}_2)-\text{COOH}$). Alanine is also the second most abundant amino acid in proteins.

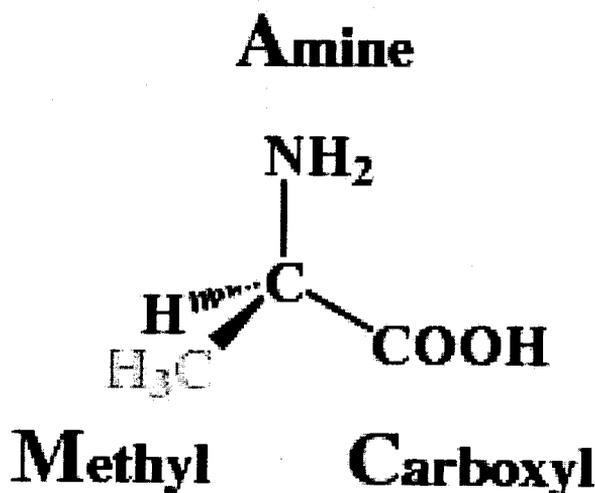


FIGURE 1. Schematic drawing of alanine molecule with functional groups.

Alanine has a methyl group ($-\text{CH}_3$) as its side chain and could be considered as a parent molecule for the other amino acids since the replacement of one or two H atoms in the methyl group with some radical gives us the structural formula of other amino acid.

EXPERIMENT

In the laboratory for Atomic Collision Processes of the Institute of Physics, Belgrade, we undertook a series of electron spectroscopic measurements to study electron collision with biologically relevant molecules (glycine, alanine, oxygen, water, tetrahydrofuran) in order to enlarge our understanding of radiation damage in biological systems. Electron energy loss spectra of glycine and alanine molecules obtained at impact energies from 20eV to 80 eV at small scattering angles, up to 5° were presented at ICPEAC conference [2]. The first investigations of electronic structure of these two amino acids along with several genealogically related molecules (formic acid, acetic acid, methyl amine) were done three decades ago by Debies and Rabalais [3] and Cannington and Ham [4] by photoelectron spectroscopy.

The apparatus used in this experiment, ESMA, is an electron spectrometer with hemispherical energy selectors both in monochromator and analyzer. It is designed for electron atom beam measurements in which a molecular beam is perpendicularly crossed by monoenergetic electron beam and had been described earlier [1].

Alanine vapor beam has been produced in the titanium oven heated by two separate coaxial heaters. The temperature of the oven was monitored by two thermopairs, one placed at the bottom of the oven, the other at the top. The temperature difference between these two positions was maintained to about 50 K.

Alanine exists under standard condition as a crystalline powder. The crucible of the oven was filled with 99% pure DL alanine without further purification. Due to the low vapor pressures of alanine, it was necessary to use elevated temperatures to obtain the formation of a molecular beam which can be achieved at temperatures of about 450 K-470K. The molecular beam was formed by effusing the molecules through a capillary into the interaction region. In the gas phase, alanine exists as the neutral molecules only whereas in aqueous solution and in the solid phase the zwitterions are the predominant form of this amino acid [5]. The scattered electrons were energy analyzed by the hemispherical selector and were detected by a single-channel electron multiplier.

RESULTS AND DISCUSSION

We have measured the angular distribution of electrons elastically scattered by alanine molecules for electron impact energies (E_0) 20eV, 40 eV, 60 and 80 eV. The scattering intensities were recorded from 10° to 150° in 10° increments. Differential cross sections for elastic electron scattering by alanine molecule at 20 eV electron impact energy are presented in figure 2. The relative DCS descends rapidly up to 90° and one can also notice the existence of the minimum at about 90° . There are no published data

to compare with present results. However, there is a similarity with the elastic DCS obtained for some other molecular targets with methyl group [6].

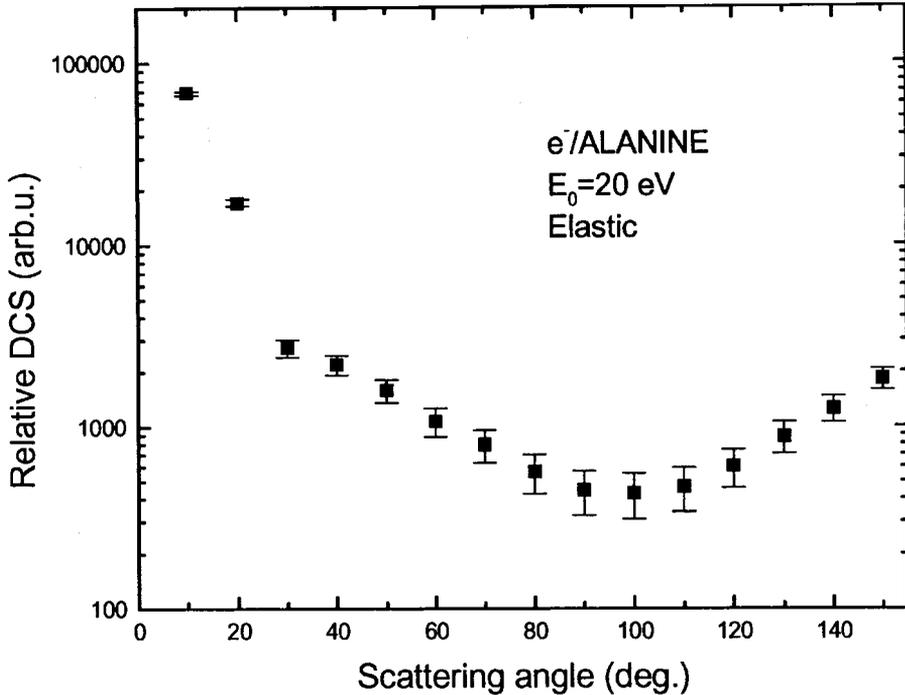


FIGURE 2. Differential cross sections for elastic electron scattering by alanine molecule at 20 eV electron impact energy.

CONCLUSION

For the first time, elastic scattering of electrons by alanine molecule was investigated. The relative elastic differential cross sections for elastic electron-alanine scattering were measured at electrons impact energies from 20eV to 80eV and within scattering angles from 10° to 150° . Obtained results at 20eV are presented.

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