

MASS SPECTROMETRIC ANALYSIS OF REACTION BETWEEN C AND
H IN ARC PLASMA

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ABSTRACT

In this paper an analysis of the chemical reactions between carbon and hydrogen occurring in the arc plasma of ethanol vapour is presented.

1. INTRODUCTION

A horizontal electric arc in a graphite tube burning in an inhomogeneous magnetic field has shown very good results in analysis of traces in ethanol solutions /1/. It is known that the chemical reactions taking place in the plasma during arc discharge affect the arc characteristics. One of the advantages of this source is a large volume of plasma so that it is very convenient for the investigation of the chemical reactions.

2. EXPERIMENTAL

In Fig.1 the experimentally applied arrangement is shown. The dimension of the graphite tube are given in Fig.1. The arc discharges between the central electrode /cathode/ and the graphite tube /anode/. The graphite tube is closed with stoppers, Z, made of the high temperature insulator

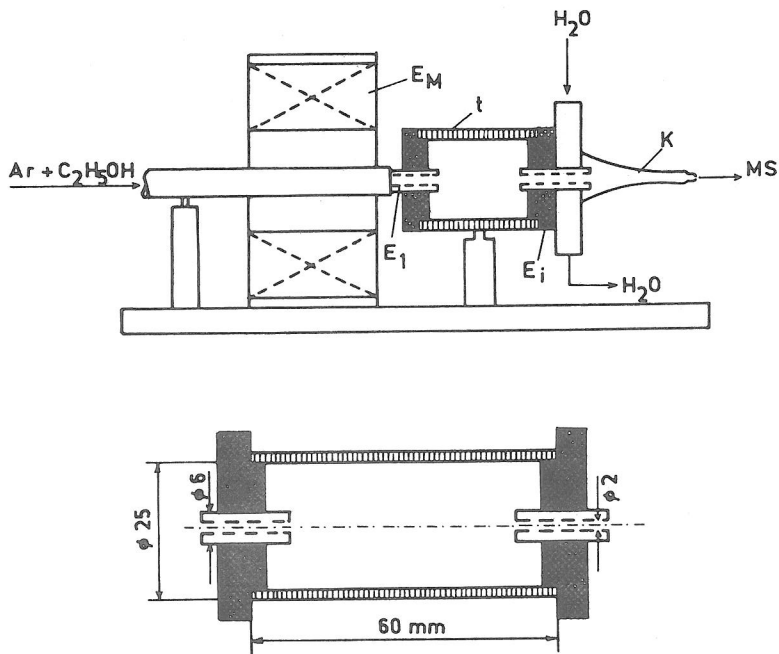


Figure 1. The arrangement for arc discharging

material. An inhomogeneous magnetic field was obtained by means of an electromagnet placed coaxially in relation to the graphite tube. Ethanol was introduced into the system through the cathode by means of the nebulizer. Argon was used as a carrier gas. The current strength of the arc was 10 A. The stable products formed during 30 s arc burning were collected with liqued nitrogen cooled trap and analyzed with a quadrupol mass spectrometer. The analyzed samples were extracted by means of a cooled stainless

steel tube. Under the action of magnetic field plasma rotates in the definite part of the graphite tube /Fig.2/. The

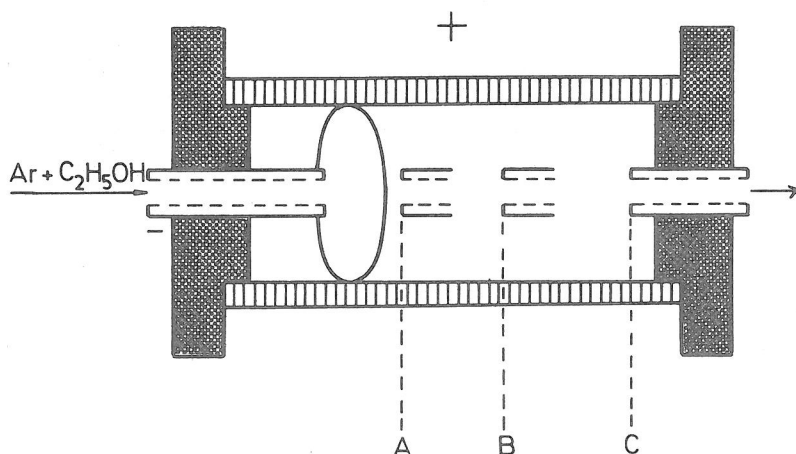


Figure 2. The position of the steel tube for sampling analyzed samples were taken from different regions of it. The positions of the steel tube in all of the investigated cases A, B and C are given in Fig. 2.

Among products appearing in the plasma the special attention was paid to the presence of C₂H₂ and C₂H₄. The experimentally obtained partial pressure of C₂H₂ and C₂H₄ in relation to the position of the tube for the sampling are presented in Fig. 3. The different ratio of the partial pressures of C₂H₂ and C₂H₄ in cases A, B and C, can be connected with the temperature gradient existing along a graphite tube.

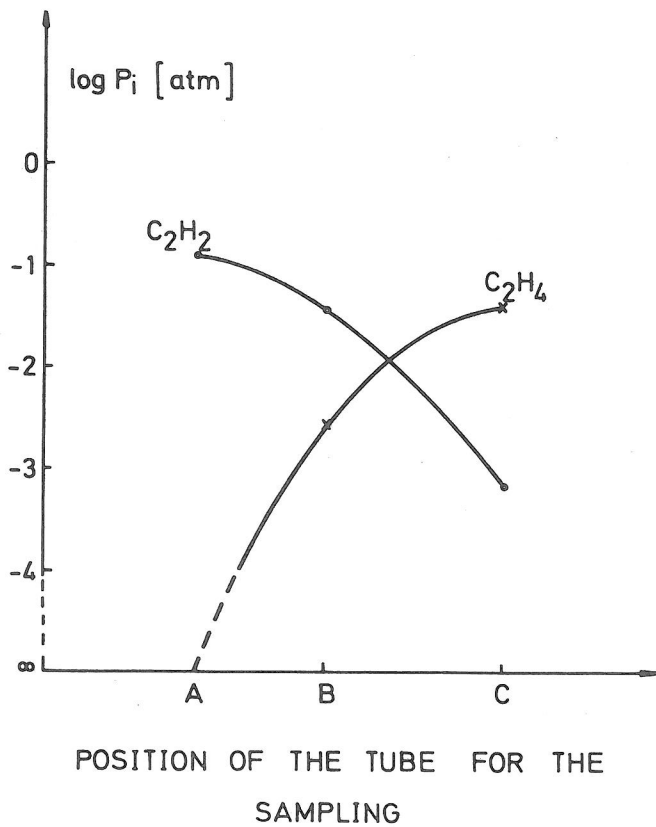


Figure 3. Experimentally obtained partial pressures of C_2H_2 and C_2H_4

The temperature dependence of the composition of a homogeneous system with the known C/H ratio can be calculated according to White et al /2/. In Fig.4 the calculated partial

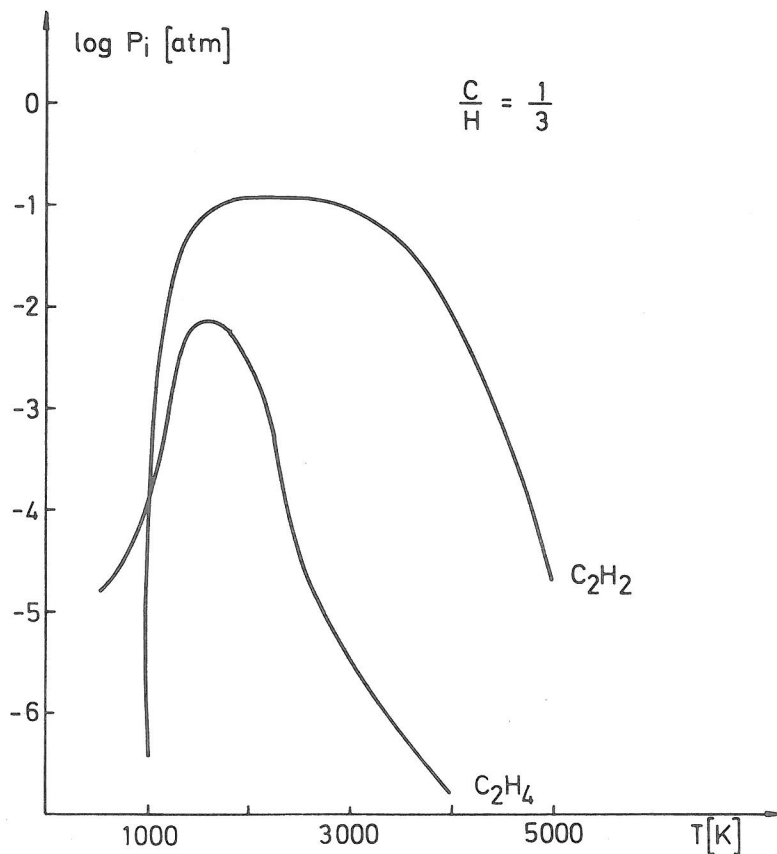


Figure 4. Calculated partial pressures of C_2H_2 and C_2H_4

pressures of C_2H_2 and C_2H_4 in the temperature range of 500-5000 K for the ratio $C/H=1/3$ are presented. The amount of C_2H_4 rapidly decreases in the temperature range above 2500K. This is in accordance with the experimentally obtained results. In the previous investigations the temperature in position A was determined to be about 3000 K /3/. This fact can explain that in this case the presence of C_2H_4 was not detected. The increase of the ratio of C_2H_4 to C_2H_2 from the position A to C /Fig.3/ can be expected according to the decrease of the temperature in this direction /Fig.4/.

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