間欠アーク放電法を用いたアミノ酸合成
Production of amino acids by use of an intermittent arc discharge

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I am interested in long-period synthesis of amino acids in space by impacts of asteroids onto satellites and planets. We have studied the impact synthesis of amino acids using a 2 staged gas-gun at JAXA, Japan. [1] Impacting a polycarbonate projectile onto an ice + iron target (an iron target or an ice + hexane + iron target) in 1 atmosphere of nitrogen gas, a hot gas plume with temperature of about 5000 K can be produced. And during the cooling process, many kinds of chemical reactions took place. By analyzing the produced soot samples, we could confirm synthesis of amino acids by the impact. [2] By considering the hot gas reactions, I point out that the reaction, $C_2 + N_2 \rightarrow 2CN$, is very important. And, I predict that CN radicals can be efficiently produced by an intermittent arc discharge, and further reactions would produce amino acids. To confirm this hypothesis, I have carried out an intermittent arc discharge in nitrogen gas. Schematic of the reactor is shown in Fig. 1. After evacuation, 40 kPa of nitrogen gas and 10 kPa of methane gas are introduced. A carbon anode with polycarbonate material and a carbon cathode are used to make a stable arc discharge. In this experiment, to protect excess heating of the produced soot sample, an intermittent discharge (the ON time of 10 s, the OFF time of 50 s, repetition of 10 series of discharge) is carried out. The total discharge time is about 100 s. By this discharge we could obtain 10 mg order of carbonaceous soot sample. To analyze the soot, the hydrolysis method and the dabsylation method are used. And, by using the chromatograph method, [3] synthesis of glycine is confirmed. 1 mg of the soot includes about 2.5 μmol of glycine. Alanine, proline, isoleucine and leucine are also confirmed to be synthesized. Now, the synthesis properties are studied in my laboratory. This study was supported by Grant-in aid from MEXT, Japan, Kiban (c).

References: [1] T. Mieno *et al*., Appl. Phys. Express **1** (2008) 067006.
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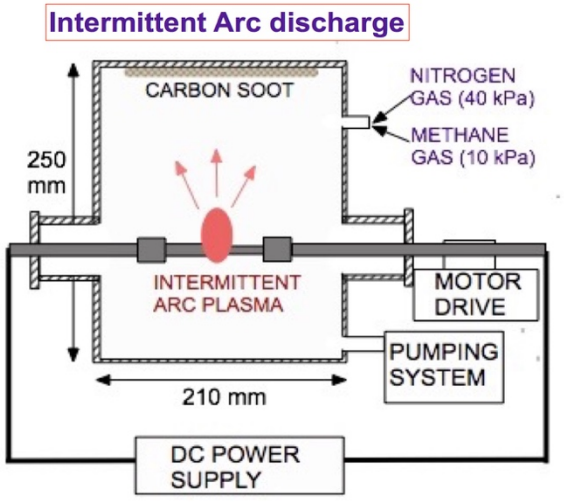

Fig. 1 Schematic of the arc reactor.