

# Influence of pressure on electrical discharge/arc transition.

R. Landfried, T. Leblanc, E. Odic, Ph. Teste

GeePs / Group of electrical engineering - Paris, UMR CNRS 8507,

CentraleSupélec, Univ. Paris-Sud, Université Paris-Saclay,

Sorbonne Universités, UPMC Univ Paris 06

11 rue Joliot-Curie, Plateau de Moulon 91192 Gif-sur-Yvette CEDEX, France

This paper reports on investigations of transitions between electrical discharges and electric arcs in argon atmosphere for different values of gas pressure. Results show that transitions may occur for same current intensity values whose range was found to be pressure dependent. .

## 1. Introduction

Electrical discharges and electric arcs have been extensively investigated. However, few studies have investigated the transitions between discharge and arc [1-3]. In many electrical power systems, electrical discharges can occur. These electrical discharges may lead to electric arcs, resulting in failure and/or destruction of the system. The aim of this work was to study the role of pressure on transition mechanism. In this objective, a specific power supply, which allows generating both electrical discharges and electric arcs with controlled current intensity, was designed and implemented [4].

## 2. Influence of pressure on the transition

Cylindrical copper or tungsten electrodes were placed in a sealed chamber containing argon gas with pressure ranging from  $10^3$  to  $10^5$  Pa. The electrode gap (denoted  $d$ ) was in the range 3 – 50 mm. For all experiments, electric discharges were first generated by applying high voltage to the argon gas gap.

### 2.1. Spontaneous transitions

In figure 1 the evolution of the current intensity (in grey) and of the electrode voltage (in black) are plotted.

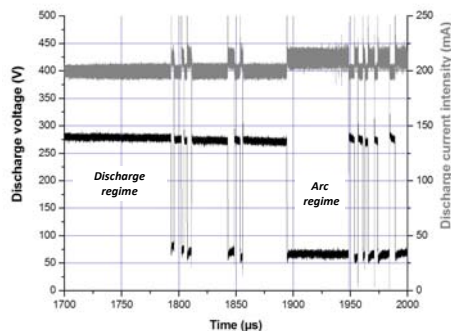


Fig. 1:  $U(t)$  and  $I(t)$  for  $P = 10^4$  and  $d = 25$ mm.

In this example where  $P = 10^4$  Pa and  $d = 25$  mm, successive spontaneous discharge-to-arc and arc-to-discharge transitions were observed for approximately constant value of current intensity. These transitions occur in some 100 ns.

### 2.2. $U(I)$ characteristics

In figure 2,  $U(I)$  characteristics are plotted for two different pressure values:  $10^4$  and  $9 \times 10^4$  Pa.

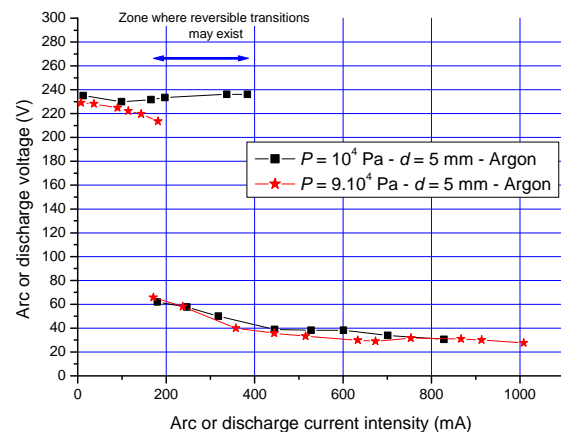


Fig. 2:  $U(I)$  characteristics for  $P = 10^4$  and  $9 \times 10^4$  Pa

According to the pressure value, transitions could occur for a precise value of the current intensity or for larger range of current intensity. In this range, discharge and arc may successively exist.

## 3. References

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