CHAPTER 1

INTRODUCTION AND A REVIEW OF PREVIOUS WORK

1.1 INTRODUCTION

The term "gas discharge" originates with the process of discharge of a capacitor into a circuit incorporating a gap between electrodes. If the voltage is sufficiently high, an electric breakdown occurs in the gas and an ionized state is formed. As gases ionized to a sufficient degree emit light, it has become customary to say that a discharge "lights up", or is "burning". Any ionized gas cannot be called plasma, of course; there is always some small degree of ionization in any gas. So the useful definition of plasma may be defined as; *plasma is a quasi-neutral gas of charged and neutral particles, which exhibits collective behavior.*

The modern field of gas discharge physics is thus occupied with processes connected with electric currents in gases and with generating and maintaining the ability of a gas to conduct electricity and to absorb electromagnetic radiation. Gas discharge physics covers a great variety of complex, multi-faceted phenomena; it is full of an enormous amount of experimental facts and theoretical models. Behaviors of the ionized gases depend on the effective ionization processes. Ionization of the electrical breakdown can be classified into gas processes (involving the collisions of electrons, ions and photons with gas atoms) and electrode processes (which take place at or near the electrode surfaces).

1.1.1 CLASSIFICATION OF DISCHARGES

There are three main types of electrical discharges that have been studied frequently, namely; the arc discharge, the glow discharge and the Townsend discharge. It is evident that the glow discharge plays an important role in the modern technology that we are witnessing nowadays. Up to now glow discharge still studied extensively, since its applications that range from household appliances (e.g. the fluorescence tube) to the most advanced technologies, (Laser pumping, sputtering thin film and deposition processes) are very important.

The large complexity of plasmas, which are applicable for industrial use, demands at first simple models and their experimental verification. The positive column of a glow discharge at low pressures represents a basic model as a starting point for further investigations. Most applications demand stable conditions, which are the exception for these kinds of discharges. This non- isothermal plasma is a striking example of non-equilibrium system with the potential to create macroscopic structures in the form of longitudinal Eigen modes of ionization waves.

1.2 THE EFFECTIVE PARAMETERS ON GLOW DISCHARGE

The physical appearance of the glow discharge has found to be affected by a set of parameters such as; the gas pressure, the electrode separation, the type of gas used, the cathode material and the current flows in the system. The effects of these parameters are described in the following sections.