CHAPTER 1
INTRODUCTION

1.1 Background

Plasma chemical vapor deposition (PCVD) has been developed since the late 19th century. It has been known that glow discharge plasmas containing reactive or polymerizable chemicals would deposit materials on the inside of vacuum systems. In the period from 1960 to 1975, research and development in this field flourished, and the technical approaches developed during this period established a basis for the thin-film PCVD techniques now to be used [1].

The literature of thin-film deposition contains numerous acronyms to describe the various forms of thin-film deposition using plasma-assisted chemical vapor deposition. Some of the more widely encountered acronyms are PECVD (Plasma-enhanced chemical vapor deposition) and APCVD (Atmospheric pressure chemical vapor deposition), etc. A variety of PCVD methods have been developed to deposit thin-films on surface, when methods that involve sputtering are unsatisfactory or not possible. Plasma polymerization is one type of PCVD, in which monomers or molecular fragments formed as plasma active species recombine on the surface of the workpiece and form a thin polymeric film [1].

Plasma was identified as a fourth state of matter by Sir William Crookes in 1879. In 1928, the concept of plasma was introduced by Irving Langmuir [2]. The technological applications of plasmas are thin-film deposition, semiconductor processing, materials treatments (modification of surface physics and surface chemistry), lamps, light sources, and materials analysis [3].

Recently, the planar coil inductively coupled RF plasma source (ICPs) has excited much interest, mainly because of its potential for satisfying the future need for a large-area, high density source in plasma processing [4]. High-pressure ICPs have been extensively studied for spectra-chemical analysis, for plasma-aided chemical

synthesis, and for crystal growth and plasma deposition. Low-pressure ICPs have been studied for applications in plasma surface modification and plasma etching [5].

1.2 Research objective

The objective of this research is to develop the radio frequency plasma enhanced chemical vapor deposition (RF-PECVD) system. The aim is also to deposit polyacetylene thin-film since it is reported to be a conducting polymer thin-film with many applications. The characteristics of RF-PECVD system, the coil currents and the coil voltage, will be studied since both factors played crucial role in the thin-film fabrication process.

1.3 Thesis organization

This thesis is divided into seven chapters. In this first chapter, an introduction, objective and organization of this research are given. In chapter 2, essential theory to be used for the studying of characteristics of the radio frequency inductive coupled plasma (RF iCP) system are described. In chapter 3, the components required for the RF-PECVD system are discussed in details. In chapter 4, the RF-PECVD system design, vacuum theory and vacuum results are explained in details. A description of experimental set-up, the diagnostic and experimental techniques, and experimental results are given in chapter 5. In chapter 6, a description of film synthesis and explanation of film analysis are given. Conclusion and discussion are presented in chapter 7.