CHAPTER I

INTRODUCTION

Surface modification of textile fabrics has become an alternative way to achieve a textile product having the properties as desired, besides synthesizing a new type of a textile fiber. Recently, many scientific literatures [2-7] have revealed a growing interest in the applications of plasma treatment on textiles due to the following advantages over conventional modification processes. For examples, in plasma treatment, only the fiber surface is modified without changing any bulk properties. Moreover, its dry process requires much simpler steps and more environmental friendly than those conventional wet processes. Furthermore, this process can be used to modify textile product in many forms including fiber or fabric and almost all compounds including inert gases such as He and Ne and non-polymer forming gases such as NH_3 and CF_4 can be incorporated into a substrate fiber by chemical and physical reactions. [1]

Previous works have emphasized on surface modification of both natural and synthetic fibers and fabrics such as poly(ethylene terephthalate), nylon, polyethylene, polypropylene and wool using cold plasmas generated from several devices. [2-7] Because these plasma generating processes are continuous, the control of plasma exposure is difficult. Therefore, a new approach for surface modification of textiles using high temperature pulsed plasma generated from a theta-pinch device was studied [6, 7]. The dynamic of this device is governed by an increase in magnetic field which

induces an electric field opposing to the direction of the discharge current. This produces plasma current that rapidly compresses toward the tube axis. The ions produced are of high energy such that they can be used for modifying material surface. Since plasma generating process of the theta-pinch device produces in pulses, it is easier to control plasma exposure on a material.

Diammonium hydrogen phosphate [$(NH_4)_2HPO_4$] is widely known as one of the effective flame retardants. However, it is easily soluble in water; consequently, it is rarely used in textile application. Therefore, the method using pulsed nitrogen plasma generated from a theta-pinch device for incorporating diammonium hydrogen phosphate onto the surface of three widely used fabrics including polyester, cotton and polyester-cotton was studied in this research. The number of plasma shot applied to the fabrics and the concentration of diammonium hydrogen phosphate solution were varied in order to determine the optimum condition for treating each fabric and resulting in an improvement of flame retardancy. Chemical structure and morphology of plasma-treated and untreated fabrics before and after washing were characterized by Attenuated Total Reflectance Fourier Transform Infrared (ATR/FT-IR) Spectroscopy and Scanning Electron Microscopy (SEM), respectively. Wettability and Flammability were also investigated.