

CHAPTER I

INTRODUCTION

For some years, several researches have focused on polyelectrolytes. Polyelectrolytes can be defined as polymers having enough ionic groups along the backbone chain to be water soluble. A polyelectrolyte may contain either positive charges (polycation), negative charges (polyanion) or both positive and negative charges (polyampholytes) which carry counterions for electroneutrality [1]. Polyelectrolytes can be dissociated into macroions and counterions in an aqueous solution accordingly to their pKa. When mixing a positively charged polyelectrolyte with a negatively charged polyelectrolyte, a complex can be formed resulting in a precipitate. These complexes have been extensively studied. Currently, polyelectrolytes are widely developed for industrial uses, for example, they are used in water treatment application where they are employed as flocculent.

The modification of surfaces by the adsorption of ultra thin films became more and more important in the last decades. This leads to the development and miniaturization of electronic and optical devices possessing new properties. Both in technical applications and basic research, it is important to understand and to control the film structure. During the last 10 years a new kind of polymer films formed by the alternate physisorption of polyanions and polycations from aqueous solutions received tremendous scientific interest. Polyanions and polycations can be deposited consecutively from aqueous solutions via Layer-by-Layer technique or Electrostatic Self-Assembly technique (ESA). The technique was first developed by Decher et al. in the early 1990s. On most of the studies, silicon wafer or glass slide serves as a substrate [2]. The principle of this technique can be summarized as follow, a substrate is successively dipped in dilutes solution of oppositely charged polyelectrolyte leading to a Layer-by-Layer deposition mode. Each adsorption step leads to a reversal of the charges allowing the deposition of the next layer until it becomes polyelectrolyte multilayer thin films (PEM). PEM have been fabricated using mainly electrostatic attraction as the driving force for multilayers, which is by no means a prerequisite. There are many other interactions that have been used successfully for multilayer deposition such as donor-accepter interaction, hydrogen bonding, covalent

bond, etc. Parameters which influence the growth of multilayer thin films are the concentration of polyelectrolyte, concentration of salt, deposition time, pH condition, type of polyelectrolyte, salt and solvent, and temperature. The main advantage of the formation of polyelectrolyte multilayer thin films using the Layer-by-Layer technique relies on the facile deposition on surfaces of almost any kind and any shape, possible to coat almost any solvent-accessible surface starting with sub-micron objects up to objects with a surface of several square meters, enabling the construction of PEM with well-defined thickness, composition, and chemical functionalities, very simple adsorption process, highly inexpensive, safe time and environmental friendly. This technique has enormous potential for the fabrication of functional films for use in various applications such as sensors, separation membranes, microcapsules, drug carrier, micro reactor, light emitting device, solar cell, quantum dots, microfluidic device, etc. Suitable support materials must carry a minimal surface charge such as glass slide, quartz, silicon wafer, mica, gold, untreated polymer: poly(ethylene terephthalate), untreated and non-polar polymer: poly(tetrafluoroethylene), polyolefins. If the charged substrates are brought into contact with the solution of a polyion of opposite charge, the first polymer layer is adsorbed and adheres by the same mechanism as the subsequent film growth by Layer-by-Layer techniques [3, 4].

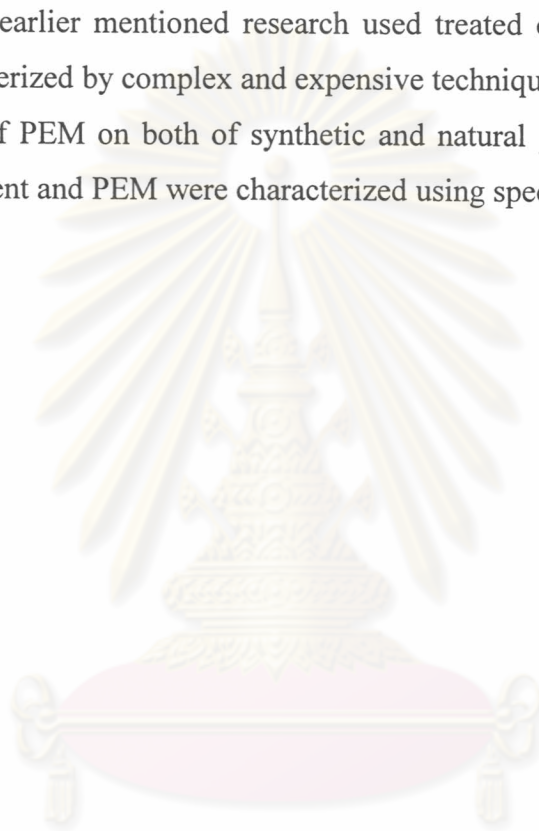
The important advantage of the new deposition technique is the facile deposition on surfaces of almost any kind and any shape of sub-micron objects up to objects with a surface of several square meters. However, only one report has been found regarding the deposition of polyelectrolyte multilayer on textile fiber substrates.

Most recently, Layer-by-Layer deposition of polyelectrolyte nano layers on cotton was published [5]. Cotton substrate for building up PEM was treated by chemical modification in order to produce cationic cotton and PEM which was constructed on cationic cotton was measured using FTIR, XPS, and TEM. This article confirmed the possibility construction of PEM on modified natural fiber, in this case, cotton.

The aim of this research is to study the formability of PEM on polyamide textile fiber substrate by Layer-by-Layer technique. Polyelectrolyte multilayer thin films from dyes and other polyelectrolytes will be form at non-dyeable condition in order to unambiguously prove that the color appearance, which is measured using a spectrophotometer, indicates that PEM are successfully deposited on polyamide fibers

substrate. The parameters controlling the growth of PEM such as salt concentration, deposition time, polyelectrolyte and dye concentrations, will be studied in order to find the suitable conditions to construct PEM on polyamide fibers substrate. An application of PEM for polyamide fibers will be demonstrated and PEM will be coated on dyed silk in order to improve color fastness after washing. Dye loading and dye release will be studied.

While the earlier mentioned research used treated cotton as a substrate and PEM were characterized by complex and expensive technique, this research will study the construction of PEM on both of synthetic and natural polyamide fibers without any further treatment and PEM were characterized using spectroscopy technique.



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