CHAPTER I
INTRODUCTION

Polymer surface modification has become a major route to achieve better polymer properties and wider polymer applications, such as adhesives, biomaterials, thin films, composites, microelectronic devices, and protective coatings. The benefit obtained from developing a newly functionalized polymer having long-term performance and great characteristics has motivated many researchers to innovate advanced techniques for polymer modification rather than synthesis approaches for a new monomer and polymer (Wypych, 1988).

Polymer modification techniques can be divided into two types: chemical modification and physical modification. Chemical modification is the modification of a polymer, by which the chemical structure of the polymers is changed by chemical reaction, such as esterification, etherification, grafting, cross-ling, and etc. On the other hand, physical modification is the modification of polymer by physical methods, such as blending with other polymers and mixing with suitable additives, etc. (Meister, 2007) The modification can be applied to polymers during or after their syntheses and during or after their manufacturing process into final products.

Surface modification of polymer films and textiles is usually necessary to improve surface wetting and adhesion characteristics. Traditional liquid chemical processes used by the textile industry involve high solvent consumption and pollution of water resources. Wastewater processing costs are high, and drying the wetted fibers is also energy-, time-, and cost-intensive. Therefore, alternative technology, especially plasma technique, is of great interest to be used for polymer surface modification, in replacing traditional processes. This plasma technology is environmentally friendly, since it does not require the use of liquid-based solvent, and there is no waste production. Moreover, the speed of the process (just a few minutes or even seconds) reduces the energy consumption.

Polyethylene terephthalate (PET) has a lot of special characteristics, such as superior strength and resilience, and it has become one of the most important materials in various industries, where it is used as a raw material for making packaging materials, such as bottles and containers for packaging a wide range of

food products and other consumer goods. In addition to the packaging materials, PET can be processed into fabric form for textile and carpet applications. Particularly, to use PET in carpet application, it requires some surface modifications to improve properties of the product. One important property is its antibacterial characteristic, which can be improved by coating antibacterial agent on the PET carpet surface.

A number of studies on improving the antibacterial property of PET have focused on investigating surface modification methods. Several methods can be applied to construct the antibacterial surface, such as radiation, UV, chemical and plasma grafting, and plasma immersion ion implantation and deposition (PIIID) (Davenas *et al.*, 2002). Previous studies indicated that PET films were modified by amorphous carbon film using acetylene PIIID to improve the antibacterial property (Wang *et al.*, 2004). Dielectric barrier discharge (DBD) plasma-modified PET surface is one of the promising methods of producing a wide range of high quality coating materials (De Geyter *et al.*, 2007). Silver exhibits good antibacterial property and in recent years has been used in modification of a variety of medical applications. However, the research on silver coating on PET carpet surface by DBD plasma technique for improving antibacterial property has less been reported.

In this research, woven PET fiber was plasma-treated with dielectric barrier discharge (DBD) under various gases (Ar, N_2, O_2, and air) and different discharge environments. In order to coat silver particles onto the fiber surface for improving antimicrobial property, the plasma-treated fiber was submerged into silver nitrate aqueous solution. The surface properties of the plasma-treated and silver-coated samples were characterized using wickability measurement, contact angle, scanning electron microscopy (SEM), atomic absorption spectroscopy (AAS), and X-ray photoelectron spectroscopy (XPS).