Chapter 2

Surface Modification Methods for Improving the Dyeability of Textile Fabrics

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Additional information is available at the end of the chapter

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1. Introduction

Polymer and textiles have a vast number of advantages and attractiveness as a material. However, despite these advantageous, polymers have limitations. In general, special surface properties with regard to chemical composition, hydrophilicity, roughness, crystallinity, conductivity, lubricity, and cross-linking density are required for successful application of polymers in such wide fields as adhesion, membrane filtration, coatings, friction and wear, composites, microelectronic devices, thin-film technology and biomaterials, and so on. Unfortunately, polymers very often do not possess the surface properties needed for these applications. In fact, polymeric fibers that are mechanically strong, chemically stable, and easy to process usually will have inert surfaces both chemically and biologically. Vice versa, those polymers having active surfaces usually do not possess excellent mechanical properties which are critical for their successful application.

Due to this dilemma, surface modification of the polymeric fibers without changing the bulk properties has been a classical research topic for many years, and is still extensive studies as new applications of polymeric materials emerge, especially in the fields of biotechnology, bioengineering, and most recently in nanotechnology.

Modification is used to designate a deliberate change in composition or structure leading to an improvement in different type of fiber properties.

The challenge is, however, that there does not exist an ideal modification that eliminates all the negative properties and preserves all the positive properties of the fibers. This is why there are a great number of different single-purpose modifications. [1]

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Effect of Plasma on Dyeability of Fabrics

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1. Introduction

The unique physical and chemical characteristics of the plasma environment make it attractive for textile processing. Plasma is an ionized gas, i.e. it contains electrons, ions and neutral atoms and/or molecules. However, not all of the ionized gases used in textile processing will exhibit the properties associated with plasmas, mainly because of their low charge state densities compared to the neutral gas density or are produced by transient phenomena.

Plasma activation is being used in several fabric and nonwoven applications in the textile industry. (Pane *et al.*, 2003)

There are many industrial applications of thin film deposition by plasma sputtering or plasma polymerization in the technical textile and nonwoven industry. Roughly, the coatings deposited in those industries can be categorized under either (permanently) hydrophilic coatings or hydrophobic/oleophilic coatings. In most cases, the deposited coatings give rise to unique products that are difficult or even impossible to produce using other technologies.

The textile market is trying to make deep, dark colours and this is not easy to achieve. (Svensson, 2004)

One way to do this is to reduce the specular component of reflection of the fabric surface after dyeing. A plasma etching leads to a controlled nano or micro-roughness, increasing diffuse reflectance and minimizing the specular component. In consequence, the dyed fabric will have an intense darker colour after plasma etching.

In various research programs, it has been shown that pick-up of dyestuff can be strongly improved after plasma pre-treatment of natural and synthetic fibre fabrics.

Polypropylene fibers have such excellent properties as low specific weight (0.91 g/cm^3 only), high strength (42-53 CN/ Tex) and good resistance to acids and alkalis, and they also possess good thermal resistance and antibacterial properties. The poor wettability (only 0.05 % at 20 °C) and dyeability have, however, limited the application of these fibers in garments and other industries (Huang et al, 2006). It is of importance to improve the wet ability and dyeability of PP fabrics for many applications. Although chemical modification of the fibers has been somewhat successful in improving hydrophilic and antistatic properties, there are environmental concerns related to the disposal of chemical after

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Diamond and Related Nanostructures

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Chapter 2
Diamond and Diamond-Like Carbon

Zahra Khalaj, Mahmood Ghoranneviss, Elnaz Vaghri, and Oana Ponta

Abstract A carbon allotrope is classified as "diamond" according to several parameters including the types of chemical bonds, type of crystal network, or range of crystal dimensionality. This chapter is a review on two major allotropes: diamond and diamond-like carbon, which are mostly produced by CVD technique. A detailed description of these techniques, as experienced by our group, is given. The importance of preparing the support for depositions and monitoring the process parameters is argued by the quality of carbon allotrope deposits, evidenced by a variety of physical measurements and microscopic images.

2.1 Introduction

Carbon is one of the most important natural elements in the periodic table, having more than one million different compounds in different forms. There exist four valance electrons in a carbon atom, two in 2s subshells and two in the 2p subshell. The atomic arrangement makes the carbon to exist with different allotropes such as diamond, diamond-like carbon, graphite, fullerene, carbon nanotubes, and carbon nanowalls and different material properties (Vaghri et al. 2012; Shams et al. 2012). This chapter is a review on two major allotropes, diamond and diamond-like carbon, that can be produced by chemical vapor deposition (CVD) techniques. Nanodiamond films (NDF) and nanocrystalline diamonds (NCD) possess high thermal

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