# UV-induced Modification of Fibers and Polymers

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## 1. INTRODUCTION

Fibers and polymers often require high degree of multi-functional properties as well as inherent properties, which are closely related with surface properties such as antistaticity, antimicrobial property, and biocompatibility, and so on. Therefore, various surface modification methods are in use to change relatively inert polymer surfaces. UV irradiation has become increasingly popular due to enhanced lamp intensity and versatile applications comparable to corona, plasma, electron beam, $\gamma$-irradiation treatment. UV/$O_3$ has been known to be a highly successful method for the surface modification of thermally sensitive polymers and fibers because the UV/$O_3$ treatment can be carried out continuously under atmospheric pressure using simple and inexpensive equipment. Moreover, UV/$O_3$ treatment of polymer surfaces requires no additional chemicals and it produces no polluting by-products. When the polymer is exposed to ozone in the presence of UV light, the surface energy of the polymer can be increased through the scission of covalent bonds and concomittant photooxidation by the ozone or oxygen on the polymer surface without the negative impact on the bulk properties

Grafting of functional monomers onto synthetic fiber, fabric or film is one of the effective ways for improving its inherent deficiency such as low dyeablility. The grafting copolymerization can be induced by EB, UV irradiation, ionizing radiation, or wet thermal treatments. Grafting is known to be useful for the introduction of various functional groups into polymeric materials by selecting a suitable monomer of functionality. UV-induced surface graft polymerization has been widely applied to the surface modification of polymers as it is a simple, useful and versatile technique. Grafting of hydrophilic monomers containing carboxylic acid, hydroxyl, or amide group onto PET is one of the effective ways to change its inherent hydrophobicity to improve hydrophilicity. (Meth)acrylic acid seemed to be the most popular monomer for the surface grafting onto various substrates because of its high reactivity.

UV-induced graft polymerization is a promising method for the surface modification of polymers because photografting is relatively simple, energy-efficient, and cost-effective process. Also the UV-induced copolymerization is suitable for the integration with other technologies such as microcontact printing and photolithography to produce desired surface chemistry in well defined two-dimensional regions on a surface. Although a large number of grafting studies have been carried out, there are still obstacles to overcome for the implementation in the commercial textile finishing including introduction of a continuous process instead of batch processes, absence of volatile organic solvents, not using inert gases or vacuum as well as grafting onto fiber or fabric forms rather than films, which is important for higher productivity, environmental friendliness, and cost effectiveness of the grafting process applicable to conventional textile finishing of porous textiles.

The introduction of crosslinking is effective in enhancing the heat stability or mechanical properties of polymeric materials. The crosslinking by irradiation can be formed by $\gamma$-ray or electron beam irradiation. Nevertheless, the irradiation crosslinking of polymers may still lack in the practical applicability considering eco-friendliness and investment cost.

To obtain functional polymers with improved specific properties such as thermal stability, mechanical strength, degree of swelling and permeability, fibers and polymers can be modified by various photon related methods such as photoirradiation, photocrosslinking and photografting. The photocrosslinking requires that the polymers contain photoreactive side groups or photosensitizer, or photoinitiator, which can induce photo generation of radicals. Photocrosslinking of macromolecules usually forms gels of three dimensional polymer network structures, which can be swollen by solvents.

## 2. ACKNOWLEDGRMENTS

This research was financially supported by grant No.RTI04-01-04 from the Ministry of Knowledge Economy(MKE).