# Development of Dyeing Technology of Super Nano Fibers

**Myung Sun Lee[1], Cho Hui Park[2], Won Ho Park[2], and Young Sik Nam[3]**

[1]Research Institute of Advanced Materials, Chungnam National University
[2]Department of Advanced Organic Materials and Textile System, Chungnam National University
[3]Chungnam National University BK21 Educational Program of Fusion Technology for Industrial Textiles
Daejeon, 305-764, Korea
E-mail: kuasik@empal.comr

## 1. INTRODUCTION

Nanofibers have interesting properties which are the results of their extremely high surface to weight ratio compared to the other conventional fibrous structures. These make nanofibers ideal for use in such application areas as filtration, sensor, protective clothing and functional materials, attributed to the high pore volume and tight pore sizes.

The improvement of thermal stable and flame retardant properties of nanofibers is a major concern in many practical applications. It is well known that aramid fibers are thermal stable and difficult to dye by conventional dyeing methods because of their extremely high glass transition temperature, high crystallinity, orientation and rigidity. Although some attempts have been made to improve their dyeability, there still few suitable techniques at present. The recommended method for dyeing aramid involves relatively high concentrations of a dye carrier in the dyebath and a high dyeing temperature for a long period of time. These conditions require substantial amounts of energy to maintain dyeing temperature and for the treatment of waste dyebath. In this study, our aim is to fabricate colored high rigidity and thermal resistant aramid nanofibers during electrospinning process adding dye or pigments.

## 2. EXPERIMENTAL

18 wt% m-aramid is used without further purification, which was supplied by HUVIS (Ltd., Co.), and was diluted with *N*,*N*-dimethylacetamide (DMAc) to 15 wt% cationic dyes or pigments were added in electrospinning polymer solution. The electrospinning needle (ID=0.838 mm) was connected to a high voltage supply (Chunpa EMT, CPS-40K03) which can generated positive DC voltage up to 40 kV. The distance between the needle tip and the ground electrode was 10 cm. The positive voltage applied to the polymer solution was 14 kV. The mass flow rate of the solution was 0.1 ml/h. All electro-spinning was carried out at room temperature. The morphology of the electrospun m-Aramid fibers were observed by field emission scanning electron microscopy (FE-SEM, JSM-7000F, JEOL) after coating the samples with gold. The average fiber diameter (AFD) was calculated using the software (Scope Eye II) on the SEM images. L*a*b* value of electrospun fibers were measured by using CR-400 (MINOLTA, Japan).

## 3. RESULTS AND DISCUSSION

Fig. 1 shows SEM images of electrospun m-aramid nanofibers which have a fine structure. But m-aramid nanofibers which added 10 wt% pigment show beads because of pigment aggregation, although the phenomenon don't appear in the nanofibers of cationic dye added.

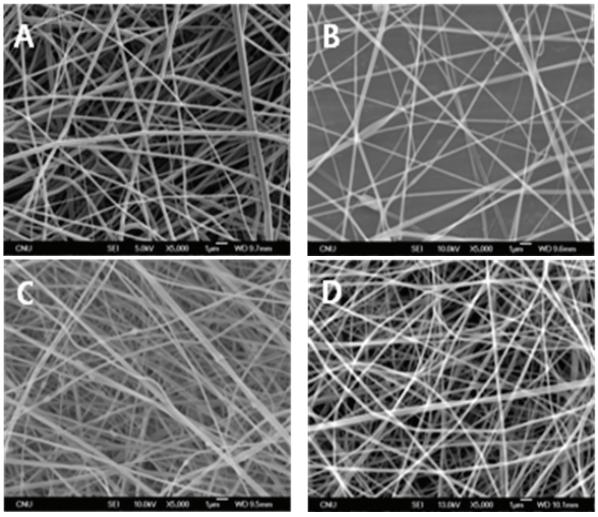


**Fig. 1.** FE-SEM images of m-aramid nanofibers.
A : m-aramid nanofibers
B : m-aramid with pigment 1 wt%
C : m-aramid with pigment 10 wt%
D : m-aramid with cationic dye 1 wt%

## 4. ACKNOWLEDGMENT

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