Preparation and Characterization of Polymer-SiO_2-Ag Nanocomposites

Ran Kim[1], Ji-yeun Kim[2], In-kyo Kim[1], Md. Shahidul Islam[1], and Jeong-Hyun Yeum[1]

[1]Department of Advanced Organic Materials Science and Engineering, Kyungpook National University, Daegu 702-701, Korea
[2]Korea Dyeing Technology Center, Daegu 703-834, Korea
E-mail:jhyeum@knu.ac.kr

1. INTRODUCTION

Hybrid nanomaterials have the capacity for producing a synergetic association of surpassing merit properties which cannot be obtained from the individual components. Such materials can be obtained by simply mixing required organic and inorganic components. The introduction of inorganic nanoparticles into the polymer matrix has proved to be an effective and low-cost method to improve the performance of the already existing polymer materials. In recent years, polymer-based nanocomposites have attracted more and more attention because nano-particles have significant surface effects, size effects, and quantum effects that improve material properties, including toughness and stiffness, transparency, scratch, abrasion, solvent, and heat resistance, and gas permeability. They have been used for medical applications, coatings, fillers, and conductive polymers [1-3].

2. EXPERIMENTAL

Polymer-SiO_2-Ag nanocpmposite was prepared according to the following procedure. SiO_2 nano-particle aqueous dispersion was treated with an ultrasonic vibrator for 1 h and then poly(allylamine hydrochloride) (PAH) solution was dropped into the SiO_2 dispersion, which was mechanically stirred simultaneously. Afterwards, polymer solution was dropped into the SiO_2 dispersion, which was mechanically stirred for 2 h to produce a stable polymer/SiO_2 solution. Polymer/SiO_2/Ag hybrid solution was made by mixing of polymer/SiO_2 solution and Ag nanoparticles dispersion with stirring for more 2 h at room temperature. Finally, this hybrid solution was cast into a polytetrafluorethylene Petri dish and dried in a vacuum oven at 50°C for 1 week to produce a nanocomposite film.

3. RESULTS AND DISCUSSION

Transmission electron microscopy showed that silica nanoparticles were dispersed well in the polymer matrix and silver nanoparticles were located on the surface of the silica and were also embedded within the polymer matrix. High-magnification TEM imaging of a localized region of the polymer nanocomposites indicated that each silica particle contains many small silver metal particles with a typical diameter between 15 to 30 nm.

4. CONCLUSION

Films of polymer/silica/Ag hybrid system were successfully prepared by the mentioned method which is feasible for making of this type of nanocomposites.

5. REFERENCES

[1] R. Zhang, and P. X. Ma; *J. Biomed. Mater Res.* 52, 430-438 (2000).
[2]] F. Bauer, V. Sauerland, and H. J. Gla¨sel; *Macromol. Mater. Eng.* 287, 546-552 (2002).
[3] S. A. Jenekhe and S. Yi; *Adv. Mater.* 12, 1274-1278 (2000).

6. ACKNOWLEDGEMENT

This research was financially supported by the Ministry of Education Science Technology (MEST) and Korea Institute for Advancement of Technology (KIAT) through the Human Resource Training Project for Regional Innovation.