Feasibility study on the contact angle measurement by laser beam projection

Seon Hoon AHN, *Seong Hun KIM, Kyung In SHIN, Seung Soon IM
Department of Fiber & Polymer Engineering, Center for Advanced Functional Polymers,
Hanyang University, Seoul 133-791, South Korea

Abstract

A newly developed contact angle measurement instrument by laser beam projection allows for rapid and direct determination of contact angles. From the result of comparative experiment and questionnaire, the laser contact angle.

Introduction

Nanofiber which has hundreds or tens of diameter, and organic/inorganic nanoparticle reinforced composites are attracting interest from many researchers because it reveals special characteristics that different from bulk materials [1]. These characteristics were mainly caused by nanometer size of the fiber or filler, and hence analyze the surface characteristics of the nanomaterials becomes important gradually. Contact angle is a well-known technique for investigating and controlling adhesion, surface treatments and cleaning, and surface modified polymer films [2-3]. The purpose of this study is to prove reliability and reproducibility of the contact angle instrument by laser beam projection compare to the conventional one by microscope.

Experimental

Contact angles were measured using the instrument developed in our laboratory. A He-Ne laser (Melles Griot, USA) was used as the source of a narrow beam. Nylon 6 used in this study was produced by Rhodia Polyamide Co., Ltd., and PP (isotactic polypropylene, MFI = 10 g/10min) was supported from Samsung General Chemicals Co., Ltd. Nylon 6 and PP were selected by consideration of hydrophilic and hydrophobic. Comparative experiment was performed to prove reliability, accuracy, reproducibility of the newly developed laser contact angle instrument.

Results & Discussion

The mean contact angles of the PP and Nylon 6 samples measured from optical microscope contact angle meter were 92.4° and 65.5°, respectively. And the results of contact angle measured from laser contact angle instrument were 87.4° and 64.0°, respectively. In case of hydrophobic sample like a PP, contact angle instrument by optical microscope was more accurate than laser instrument, and close to theoretical values. In laser contact angle measurement, the sample stages of the laser instrument hindered reflected beam, so the results of hydrophobic specimen have small values. However, the contact angles of the hydrophilic sample, Nylon 6, were closed to theoretical values. Contact angle instrument by laser beam projection have smaller standard deviation and variation of the contact angle than conventional one, therefore reproducibility and accuracy was improved. From the result of questionnaire, 11 of the experimenter answered the contact angle instrument by laser beam projection was more faster than the conventional one, and 15 of the experimenter answered laser contact angle instrument was more convenience and easier than optical microscope contact angle instrument.

Conclusions

The feasibility of the contact angle instrument by laser beam projection was studied to estimate textile materials which weaved from nanofiber, and composite material which reinforced into nanoparticles through comparative experiment and questionnaire. The test result revealed that newly developed laser contact angle instrument was more objective, reproducible, and faster than conventional one.

References

1. S. H. Kim, S. H. Ahn, Polymer, **44(9)**, 5625-5634, (2003).
2. A. W. Adamson, "Physical Chemistry of Surfaces", John Wiley & Sons, New York, 379-411, (1990).
3. D. J. Shaw, "Introduction to Colloid and Surface Chemistry", Butterworth & Co, London, 127-141, (1986).