

# Adherent Natural Soils on Fiber Surfaces

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## Abstract

Adherent natural soils on fiber surfaces have been studied with the scanning electron microscope. The soils on the fiber surface resemble oily soil.

## Introduction

ALTHOUGH ADHERENT NATURAL SOILS ON fiber surfaces have been studied with the electron microscope (1), the condition of natural soils cannot be clearly observed by electron microscopes of the transmission type. Recently however a scanning electron microscope has been developed (Japan Electron Optics Laboratory Company Ltd., Japan), whereby, when a fiber surface is bombarded by a sharply focused electron probe, a wealth of information on the fiber surface can be obtained through secondary electrons, backscattered electrons, adsorbed electrons, and the electromotive force caused by irradiation with the probe.

The scanning electron microscope has features differing from the transmission type of electron microscopes. Specifically the depth of focus is greater than that of ordinary electron microscopes or optical

microscopes, and the sample can be observed directly without any such special treatment as replication (2).

Therefore this paper represents a study of the adherent nature of natural soils on fiber surfaces, as observed with the scanning electron microscope.

## Procedures

Cotton cloth was Burod No. 60 (Kanebou Company), underwear, extracted with ethyl ether, (Gunzei Company), and polyester cloth (Nakao Filter Company, 75 denier). The fabrics were soiled by wear for a three-day period by an adult male during the summer.

The natural soils on the fiber surfaces are shown in Fig. 1, 2, and 3. From the figures it is apparent that the natural soils were distributed among the fibers by mechanical rubbing during wear. Furthermore, the soils on the fiber surface resemble oily soil and adhere similarly. The effect of these soils is apparent. It is expected that, when the natural soils are transferred to the fiber surface from the human skin, the contact angle of soils to the fiber surface may be small. Hence the natural soils spread readily on the fiber surface. This phenomenon is more noticeable with the polyester fabric, which is more lipophilic than the cotton fiber.

## ACKNOWLEDGMENT

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1. Powe, W. C., *Tex. Research J.* 29, 879 (1959); M. J. Rollins, A. T. Moore, and I. V. deGruy, *Am. Dyestuff Repr.* 52, 479 (1963).
2. *The News of Japan Electron Optics Laboratory*, October 1967.

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Fig. 1. Cotton cloth soiled by neck wear (Burod No. 60): (a) unsoiled cloth, 1,000 $\times$ ; (b) soiled cloth, 300 $\times$ ; (c) soiled cloth, 3,000 $\times$ .

Fig. 2. Underwear: (a) unsoiled, 1,000 $\times$ ; (b) soiled, 1,000 $\times$ .

Fig. 3. Polyester cloth soiled by neck wear: (a) unsoiled, 1,000 $\times$ ; (b) soiled, 1,000 $\times$ .

