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TEXTILE FIBERS DEPARTMENT

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SECTION I - TEFLON®

A. FC-143 in Teflon® Products - S. S. Shelburne

Objective: Determine levels of FC-143 in the Teflon® process, the conditions and mechanism for removal of and the identification of byproducts of thermal treatment.

Status: Analysis of thermal treatment of FC-143 sodium salt is complete. The results show that a FC-143 sodium salt present on Teflon® I and T products can be removed by thermal treatment at temperatures of 175°C or higher. In the presence of the Triton X100 emulsifier, the major reaction is decarboxylation (90%) with carbon dioxide and perfluoroheptamono-hydride gases as the byproducts. Although thermal treatment can effectively remove the FC-143, it is not the prime candidate because of possible deleterious effects on product performance.

ARL (Mokhtar) has shown that Teflon® I and T yarns heated at 175°C for 30 minutes or 200°C for 10 minutes no longer have any extractable FC-143. IR scans of off-gas from yarns heated at 200°C and 250°C confirm the presence of a fluorocarbon gas by the absorption peak at 1250 cm⁻¹. The presence of the CO₂ peak at 2350 cm⁻¹ confirms CO₂ evolution, i.e., the FC is decarboxylating. There is no carboxyl peak present which would show that the FC-143 is evaporating. Further study of the gases evolved at 200°C from Triton X100/FC-143 sodium salt mixtures in a 5:1 ratio, show the presence of a C-H absorption peak at 3010 cm⁻¹. This shows that the fluorocarbon gas evolved on decarboxylation is the perfluoromono-hydride. There is no evidence of an olefine (C = C, 1790 cm⁻¹) which was a possible decomposition product. (Figure I-SSS). The Triton X-100 supplies the hydrogen necessary to form the hydride. Analysis of the completeness of the decarboxylation was made by passing known amounts of off-gas through a Draeger tube. The tube, specific for CO₂, uses a color change to volumetrically measure the CO₂ evolved. The amount was 90 ± 10% of the theoretical, showing that no other major reaction occurs during thermal treatment.

The new Ni₆₃ electron capture detector has been installed on the HP5880 and is in the process of being checked out. This will be used for blood analysis and for rechecks of area air samples.

SSS/dsa

CP 3 (CF) 6 CF 100 100 100
 PO 145 100 100 100 100
 heated to 300°C

NS= 30
 SC= 1
 PE= 1100
 DE= 1.00
 CAN 2

NICOTEX SAMPLE

66.65 51.09 35.53 19.97 4.41

4000 3000 2000 1500 1000 500 0

WAVENUMBERS

% TRANSMITTANCE

2.3000W