

Study on Syntheses of Phosphates and Transition-Metal Complexes on Viscose Rayon Felt for Flame Retardancy

YOUNG GUN KO,^{1,2} UNG SU CHOI,¹ BYENG GIL AHN,¹ DONG JUNE AHN²

¹ Tribology Research Center, Korea Institute of Science and Technology, P.O. Box 131, Cheongryang, Seoul 130-650, Korea

² Department of Chemical Engineering, Korea University, Anamdong 5ga-1, Seoul 136-701, Korea

Received 21 February 2000; accepted 15 May 2000

ABSTRACT: High-performance materials for flameproofing, phosphates (polyphosphate and ammonium phosphate) were synthesized on viscose rayon felt. This surface reaction has the advantage of a nonblooming effect and an application in thermosetting plastics. Metal complexes have the effect of reducing the amount of smoke. Therefore, in the second step, transition-metal complexes were synthesized on the viscose rayon ammonium phosphate felt. This article focuses on the surface modification of phosphates and metal complexes on viscose rayon. All reactions were confirmed by attenuated total reflectance Fourier transform infrared and time-of-flight secondary ion mass spectrometry. As the concentrations of phosphoric acid and urea increased, the peak intensities of ammonium ion groups and phosphate groups greatly increased. The thermal properties of the synthesized materials were studied with thermogravimetric analysis and oxygen index testing. On the basis of the experimental results, the synthesized flame-retardancy materials showed excellent physicochemical and thermal effects and flame retardancy. © 2000 John Wiley & Sons, Inc. *J Polym Sci A: Polym Chem* 38: 2815–2823, 2000

Keywords: viscose rayon; flameproof material; phosphate; ammonium phosphate; polyphosphate; metal complex

INTRODUCTION

The chemistry of polymer surfaces has an important role in many polymer fields. Polymer-surface modification has been studied for many years, and several technologies have been used to change the interfacial properties while those of the matrix are maintained. Surface-modification techniques that can transform these inexpensive materials into valuable finished products have become an important part of the plastics industry.^{1–4}

Cellulose and viscose rayon-based flame-retardancy materials have been studied by many researchers for many years.^{5–9} One method for syn-

thesizing these materials is a surface reaction. Surface reactions are widely applied in synthesizing flame-retardancy materials because a blooming effect does not occur on the surface and the reactions can be applied to thermosetting plastics. Another type of flame retardant is additives; these materials have a chemical composition that makes them easily amenable to interactive flameproof treatments.¹⁰

However, additives have the disadvantage of needing to be used in relatively high concentrations (typically 30% by weight or more), and this may affect the physical and mechanical properties of the polymers. Also, additives may leach or volatilize from the polymer during service.¹¹

In this study, polyphosphate and ammonium phosphate were formed by the reaction of phosphoric acid and urea with viscose rayon as a ma-

Correspondence to: U. S. Choi (E-mail: uschoi@kist.re.kr)

Journal of Polymer Science: Part A: Polymer Chemistry, Vol. 38, 2815–2823 (2000)
© 2000 John Wiley & Sons, Inc.