

Thesis Title A Study of the Properties of Vulcanised Rubber Dust
 Filled Poly(vinyl chloride)

Name Domesak Kritayahun

Degree Master of Science (Polymer Science)

Thesis Supervisory Committee

 Pranee Phinyocheep, Doctorat de l' Universite' du Maine

 Frederick Henry Axtell, Ph.D., F.I.M.

 John Ellis, M.Sc., F.I.M.

Date of Graduation 2 May B.E. 2540 (1997)

ABSTRACT

Three types of rubber scrap dusts : midsole dust (scrap dust of vulcanised EVA foams), outsole (scrap dust of vulcanised blend of NR, BR, and SBR) and laminate dust from the assembly sole (a laminate of the midsole and the outsole) from the sport shoes manufacture are reused as impact modifiers for PVC. Four types of compatibiliser : (a) Ethylene Acrylic elastomer (VAMAC[®]), (b) Ethylene Vinyl Acetate, consisting of 17%VA (EVA), (c) Ethylene Acrylic Acid ionomer (EAA) and (d) Styrene-Butadiene-Styrene (SBS) were used to promote adhesion between the phases of the PVC and the rubber dusts. The properties of these PVC compounds were investigated.

The masterbatch of scrap rubber dust and compatibilisers were prepared by two-roll milling. A single screw extruder was used for melt blending of PVC and masterbatch. The properties of the extruded

compounds were studied and compared with the compounds which were reprocessed by injection moulding. The toughness of the compounds was evaluated using Charpy notched impact testing. The PVC compounds obtained by the extrusion and injection moulding process gave higher impact resistance than virgin PVC by about 30%-520% depending on the type and amount of dust loading. The compound containing 30 phr of masterbatch of midsole and VAMAC gave the highest impact strength. However, the impact strength of the corresponding extrudate after further processing by injection moulding were less pronounced.

The morphology of the PVC compounds were studied using an optical microscope. The particle size and particle size distribution of the dust were measured with the aid of an image analyser. Solvent immersion was used to observe the fusion of the PVC compound as a qualitative analysis. Shrinkage testing was conducted to study the effect of molecular orientation of the specimens on the impact property. To evaluate the flow property of the compounds, the melt flow index tester was used. Thermal degradation of the compounded PVC during the secondary process was also investigated by FTIR. It was found that the impact strength of the PVC compounds did not depend on the particle size and particle size distribution of the rubber dust but depended on processing history, type and amount of scrap, and types of compatibiliser used. Analysis of tensile properties data in terms of the theoretical models is attempted to obtain better insight into the interphase adhesion and stress concentration effect in the compounds. Increasing the concentration of the rubber dust decreased the compound's yield stress, UTS and modulus due to the dilution and stress concentration effects.