CHAPTER I

INTRODUCTION

The Telephone Organization of Thailand (TOT) conducted one research on crossarm which is used to top hold the pole for hanging up cable lines [1]. This current study attempted to explore a new material for replacing wood in the crossarm production. It was found that the channel steel was the most appropriate for the TOT's network. Nevertheless, the steel crossarm causes a problem of electrical conductivity, which is rather dangerous for both the systems and people. To solve this problem, electric insulator material made of polyurethane was usually coated on a steel surface. However, polyurethane is very expensive because it must be imported from foreign countries. Also, the tear strength and ozone resistance of polyurethane are not good enough. The present research therefore attempts to explore another electric insulator material to substitute polyurethane.

One interesting material for such a substitution is the natural rubber because of its high insulation properties and low price. Besides, it is abundant and easily found in this region. Since there is a number of natural rubbers being produced in Thailand of almost 2 million tons per year, but only 8-10% of the total amount or 150,000 tons [2] is consumed. The use of the natural rubber not only saves cost but also increases value of natural rubber. Nonetheless, the natural rubber has poor ozone resistance because of a lot of double bonds on unsaturated rubbers. This limitation can be eliminated by mixing the natural rubber with waxes and antiozonants, or by blending with materials

containing low unsaturation level such as ethylene propylene diene monomer (EPDM) and ethylene propylene monomer (EPM).

The NR and EPDM are blended in order to combine the excellent physical properties of NR with the ozone resistant properties of EPDM. The principal target application for such blending has for many years been tyre sidewalls [3] where ozone cracking was seen as a limiting factor on the lifetime of tyre. As a consequence, many products dominated by NR, such as, domestic appliances, weatherseal profiles for vehicles almost entirely superseded by EPDM.

In this research, two other substances, namely, silica and carbon black are filled with rubber. Because silica can improve mechanical properties, while carbon black can improve thermal and electrical properties for NR and EPDM blends. In the compounding, the ratio of NR used will be higher than that of EPDM. We use only EPDM to improve the ozone resistance of NR, therefore the antioxidant is not used in this study. The properly compounded rubber will be used as an electric insulator material for coating on channel steel crossarms at a later stage.

1.1 Objectives

The objective of the study is to investigate the proper composition of NR and EPDM, which has the specifications of high insulation, antiozone and thermal ageing resistance, and gives proper physical and mechanical properties suited for the TOT's network [4]. For the utmost expectation, it should be of low cost as a coating material with high efficiency and long life.

1.2 Scope of the present thesis

The purpose of the study is to investigate the proper composition of NR and EPDM, which increases the ozone resistance, improves physical and mechanical properties, and enhances compatibility. As a result, the amount of NR used is more than that of NR used to reinforce the ozone resistance, while reinforcing fillers will be employed to strengthen the ozone resistance. Also, the homogenizing agent (Ultrablend 4000) will be applied to improve compatibility. Thus, the scope of this thesis will be itemized as follows:

1. The effect of the amount of carbon black on electrical properties of rubber blends.
2. The effect of the homogenizing agent (Ultrablend 4000) on compatibility between NR/EPDM blends characterized by rheological and microscopic techniques.
3. The effect of ratio of NR/EPDM blends on the extent of ozone resistance.

Electrical, mechanical and thermal properties of blends were measured according to ASTM and ISO standards. Compatibility of the rubber blends was determined by scanning electron microscopy (SEM), rheology technique, and pulsed nuclear magnetic resonance (pulsed-NMR).