CONTROL OF PHASE MORPHOLOGY OF NATURAL RUBBER/EPDM BLENDS AND ITS EFFECTS ON OZONE RESISTANCE OF THE BLENDS

PATHOMPONG PANGAMOL

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (POLYMER SCIENCE AND TECHNOLOGY) FACULTY OF GRADUATE STUDIES MAHIDOL UNIVERSITY 2010

COPYRIGHT OF MAHIDOL UNIVERSITY
CONTROL OF PHASE MORPHOLOGY OF NATURAL RUBBER/ EPDM BLENDS AND ITS EFFECTS ON OZONE RESISTANCE OF THE BLENDS

PATHOMPONG PANGAMOL  5137730 SCPO/M

M.Sc. (POLYMER SCIENCE AND TECHNOLOGY)

THESIS ADVISORY COMMITTEE: KRISDA SUCHIVA, Ph.D. (POLYMER SCIENCE), PONGDHORN SAE-OUI, Ph.D. (RUBBER ENGINEERING)

ABSTRACT

This research focused on the improvement of ozone resistance of natural rubber (NR) by blending it with ethylene-propylene-diene rubber (EPDM). The study covered the whole range of NR/EPDM blend compositions from 20/80 to 80/20 of NR/EPDM. The concept was to adjust the ozone resistant property by controlling the phase morphology of the NR/EPDM blend. The blend morphology which was expected to show ozone resistance was the one, which had EPDM as the matrix phase. The target was to find the blend composition, which had the highest NR content but still exhibited ozone resistance.

The phase morphologies of the NR/EPDM blends were controlled in the present study by adjusting the relative viscosity of NR and EPDM. Liquid polyisoprene (LIR) and liquid EPDM (LEPDM) were used to adjust the viscosities of NR and EPDM. The results showed that the phase morphologies of the NR/EPDM blends were basically controlled by the NR/EPDM blend ratio. The 20/80 blends of NR/EPDM exhibited dispersion of NR in the EPDM matrix. With increasing NR content in the blends, co-continuous phase morphologies were formed which occurred at the NR/EPDM blend ratios of 40/60 and higher. NR then turned into the continuous phase when its content in the blend was 70 and 80 wt%.

The NR/EPDM viscosity ratio was found to have significant effects on the phase structures of the blends. As the viscosity ratio was increased from 0.7 to 1.0, 1.6, 2.3 and 3.2, the dispersed phase and the co-continuous phase were found to decrease in sizes. An interesting effect of relative viscosity of NR/EPDM was to cause inversion of the phase in the 70/30 blend of NR/EPDM when the relative viscosities of NR/EPDM were greater than 1.6. Thus, for these blends, EPDM formed the matrix phase and the blends exhibited ozone resistance. All the other NR/EPDM blends showed ozone resistant properties except the 80/20 blends of NR/EPDM and the 70/30 blends prepared by using the viscosity ratios of 0.7 and 1.0.

Measurement of the tensile properties and the hardness of the blends revealed that tensile strengths, 300% moduli, elongations at break and hardness values increased with increasing NR content in the blends and decreased with increasing viscosity ratio of NR/EPDM.

KEY WORDS: MORPHOLOGY / NATURAL RUBBER / EPDM BLENDS / OZONE RESISTANT PROPERTIES / VISCOSITY RATIOS

72 pages
CONTROL OF PHASE MORPHOLOGY OF NATURAL RUBBER/EPDM BLENDS AND ITS EFFECTS ON OZONE RESISTANCE OF THE BLENDS

72