# REFERENCES


1. Kim, J.K. and Burford, R.P. (1998). Study on Powder Utilization of Waste Tires as a Filler in Rubber Compounding. Rubber Chem. Technol. 71:1028-1041.
2. Rajalingam, P., Sharpe, J., and Baker, W.E. (1993). Ground Rubber Tire/Thermoplastic Composites: Effect of Different Ground Rubber Tires. Rubber Chem. Technol. 66:664-677.
3. Holden, G., Norman, R.L., Roderic, P.Q., and Herman, E.S. (1996). Thermoplastic Elastomers. 2nd Edition. New York: Carl Hanser Verlag.
4. Oderkerk, J. and Groeninckx, G. (2002). Morphology Development by Reactive Compatibilisation and Dynamic Vulcanization of nylon6/EPDM Blends with a High Rubber Fraction. Polymer. 43:2219-2228.
5. Makarov, V.M., and Drozdovski, V.F. (1991). Reprocessing of Tyres and Rubber Waste Recycling from the Rubber Products Industry. 1st Edition. England: Ellis Horwood.
6. Ouederni, M. and Phillips, P.J. (1995). Influence of Morphology on the Fracture Toughness of Isotactic Polypropylene. J. Polym. Sci : Part B : Polymer physics. 33: 1313-1322.
7. Karger-Kocsic, J. (1995). Polypropylene Structure, Blends and Composite, Composites. London: Chapman&Hall.
8. Arends, C.B. (1996). Polymer Toughening. New York: Marcel Dekker.
9. Brown, N., Lu, X., Huang, Y.L., and Quian, R. (1991). Makromol. Chem., Macromol. Symp.41:55.
10. Haward, R.N., and Owen, D.R.J. (1977). J. Proc. R. Soc. (Lond.). A352:505.
11. Odian, G. (1991). Principles of Polymerization. 3rd Edition. New York:John Wiley&Sons.
12. Sperling, L.H. (1992). Introduction to Physical Polymer Science. 2nd Edition. Singapore:John Wiley&Sons.
13. Walker, B.M. (1979). Handbook of Thermoplastic Elastomers. New York: Van Nostrand-Reinhold.

14. Pechhold, E., Pruckmayr, G., and Robinson, I.M. (1980). Rubber Chem. Technol. 53:1032.

15. Nishimura, A.A., and Komogata, H. (1967). J. Macromol. Sci., Chem. A1:617.

16. Chough, S.H., and Chang, D.H. (1996). Kinetics of Sulfur Vulcanization of NR, BR, SBR and Their Blends Using a Rheometer and DSC. J. Appl. Polym. Sci. 61: 449-454.

17. Legge, N.R. (1987). Thermoplastic Elastomer. New York.

18. Kofmann, W. (1989). Rubber Technology handbook. New York.

19. Yoon, L.K., Choi, C.H., and Kim, B.K. (1995). Reactive Extrusion of PP/Natural Rubber Blends. J. Appl. Polym. Sci. 56: 239-246.

20. George, S., Neelakantan, N.R., Varughese, K.T., and Thomas, S. (1997). Dynamic Mechanical Properties of Isotactic Polypropylene Nitrile Rubber Blends. J. Polym. Sci. Part B: Polymer Physics. 35:2309-2327.

21. Cogswell, F.N. (1981). Polymer Melt Rheology. New York:John Wiley&Sons.

22. Oliphant, K., and Baker, W.E. (1993). The Use of Cryogenically Ground Rubber Tires as a Filler in Polyolefin Blends. Polym. Eng. Sci. 33:166-174.

23. Naskar, A.K., Bhowmick, A.K., and De, S.K. (2001). Thermoplastic Elastomeric Composition Based on Ground Rubber Tire. Polym. Eng. Sci. 41:1087-1098.

24. Tsenoglou, C., Kartalis, C.N., Papaspyridedes, C.D., and Pfaendner, R. (2001). Modeling the Role of Stabilizing Additives During Melt Recycling of High Density Polyethylene. J. Appl. Polym. Sci. 80: 2207-2217.

25. Miller, P., Sbarski, I., Kosior, E., Masood, S., and Iovenitti, P. (2001). Correlation of Rheological and Mechanical Properties for Blends of Recycled HDPE and Virgin Polyolefins. J. Appl. Polym. Sci. 82: 3505-3512.

26. Sombatsompop, N., and Thongsang, S. (2001). Rheology, Morphology and Mechanical and Thermal Properties of Recycled PVC Pipes. J. Appl. Polym. Sci. 82: 2478-2486.

27. Zhang, J.F., Zheng, Q., Yang, Y.Q., and Yi, X.S. (2002). High Density Polyethylene/ Carbon Black Conductive Composites. J. Appl. Polym. Sci. 83: 3117-3122.

28. Thongruang, W., Balik, C.M., and Spontak, R.J. (2002). Volume Exclusion Effects in Polyethylene Blends Filled with Carbon Black, Graphite or Carbon Fiber. J. Polym. Sci. Part B: Polymer Physics. 40: 1013-1025.

29. Lee, M.G., and Nho, Y.C. (2002). Electrical Resistivity of Carbon Black Filled High Density polyethylene Composites. J. Appl. Polym. Sci. 83: 2440-2446.

30. Naskar, A.K., Khastgir, D., Bhowmick, A.K., and De, S.K. (2002). Effect of Chlorination of Ground Rubber Tire on Its Compatibility with Poly(vinyl chloride): Dielectric Studies. J. Appl. Polym. Sci. 84: 993-1000.

31. Naskar, A.K., Bhowmick, A.K., and De, S.K. (2002). Thermoplastic Elastomer Composition Based on Maleic Anhydride-Grafted Ground Rubber Tire. J. Appl. Polym. Sci. 84: 370-378.

32. Radheshkumar, C. and Karger-Kocsis, J. (2002). Thermoplastic Dynamic Vulcanisates Containing LDPE, Rubber and Thermochemically Reclaimed Ground Tyre Rubber. Plast. Rubber Compos. 31: 99-105.

33. Oderkerk, J., and Groeninckx, G. (2002). Morphology development by reactive compatibilisation and dynamic vulcanization of nylon6/EPDM blends with a high rubber fraction. Polymer 43: 2219-2228.

34. Tripathy, A.R., Patra, P.K., Sinha, J.K., and Banerji. S. (2002). Application of Differential Scanning Calorimetry and Diffential Thermogravimetry Techniques to Determine the Ratio of Blend Components in Reactive Chlorinated Elastomer Blends. J. Appl. Polym. Sci. 83: 937-948.

35. Sombatsompop, N., and Kumnuantip, C. (2003). Rheology, Cure Characteristics, Physical and Mechanical Properties of Tire Tread Reclaimed Rubber/Natural Rubber Compounds. J. Appl. Polym. Sci. 87: 1723-1731.

36. Tantayanon, S., and Juikham, S. (2004). Enhanced Toughening of Poly(propylene) with Reclaimed-Tire Rubber. J. Appl. Polym. Sci. 91: 510-515.

37. Grigoryeva, O.P., Fainleib, A.M., Tolstov, A.L., Starostenko, O.M., and Lievana, E. (2005). Thermoplastic Elastomers Based on Recycled High Density Polyethylene, Ethylene-Propylene-Diene Monomer Rubber and Ground Tire Rubber. J. Appl. Polym. Sci. 95: 659-671.

38. Phadke, A.A., and De, S.K. (1986). Effect of Cryo-Ground Rubber on Melt Flow and Mechanical Properties of Polypropylene. Polym. Eng. Sci. 26:1079-1087.

39. Nevatia, P., Banerjee, T.S., Dutta, B., Jha, A., Naskar, A.K., and Bhowmick, A.K. (2002). Thermoplastic Elastomers from Reclaimed Rubber and Waste Plastics. J. Appl. Polym. Sci. 83: 2035-2042.

40. Mousa, A., Ishiaku, U.S., and Mohd Ishak, Z.A. (2000). Rheological Properties of Dynamically Vulcanized Poly(vinylchloride) /epoxidized Natural Rubber Thermoplastic Elastomers: Effect of Processing Variables. Polymer testing 19: 193-204.

41. Subhasish, P., and Kale, D.D. (2002). Rheological Study of Polypropylene Copolymer/ Polyolefinic Elastomer Blends. J. Appl. Polym. Sci. 84: 665-671.

42. Xiao, H.W., Huang, S.Q., Jiang, T., and Cheng, S.Y. (2002). Miscibility of Blends of EthylenPropylene-Diene Terpolymer and Polypropylene. J. Appl. Polym. Sci. 83: 315-322.

43. Dealy, J.M., and Wissbrun, K.F. (1990). Melt Rheology and Its Role in Plastics Processing. New York:Van Nostrand Reinhold.

# APPENDICES

# APPENDIX A

## Notch-Izod Impact Strength of RTR/Polyolefin Blends

**Table A.1** Notch-Izod Impact Strength of RTR/HDPE Blends at 50/50 and Using Sulphur Vulcanizing Agent.

| | Notch-Izod Impact Strength (Kg-cm)/cm notch | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vulcanizing agent | 1st | 2nd | 3rd | 4th | 5th | Data | X | SD |
| Sulphur | 114.93 | 111.17 | 118.90 | 118.90 | 114.93 | 5 | 116.77 | 3.24 |
| Mixed | 82.10 | 87.77 | 82.1 | 87.77 | 87.77 | 5 | 86.50 | 3.10 |
| Peroxide | 70.70 | 70.80 | 65.37 | 70.80 | 68.07 | 5 | 70.15 | 2.41 |
| Compatibilizer | 117.53 | 129.80 | 117.53 | 117.53 | 117.53 | 5 | 120.98 | 5.48 |
| Without vulcanizing agent | 79.17 | 65.37 | 65.37 | 79.17 | 79.17 | 5 | 74.65 | 7.55 |

**Table A.2** Notch-Izod Impact Strength of RTR/LDPE Blends at 50/50 and Using Mixed Vulcanizing Agent.

| | Notch-Izod Impact Strength (Kg-cm)/cm notch | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vulcanizing agent | 1st | 2nd | 3rd | 4th | 5th | Data | X | SD |
| Sulphur | 30.60 | 28.37 | 30.60 | 28.37 | 26.20 | 5 | 29.83 | 1.84 |
| Mixed | 60.13 | 56.13 | 56.13 | 56.13 | 60.13 | 5 | 58.73 | 2.19 |
| Peroxide | 45.69 | 47.17 | 47.17 | 42.66 | 42.66 | 5 | 46.07 | 2.28 |
| Compatibilizer | 37.50 | 37.50 | 37.50 | 42.26 | 42.26 | 5 | 40.40 | 2.61 |
| Without vulcanizing agent | 34.12 | 35.63 | 34.12 | 35.62 | 33.28 | 5 | 35.55 | 1.03 |

**Table A.3** Notch-Izod Impact Strength of RTR/LLDPE Blends at 50/50 and Using Mixed Vulcanizing Agent.

| | Notch-Izod Impact Strength (Kg-cm)/cm notch | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vulcanizing agent | 1st | 2nd | 3rd | 4th | 5th | Data | X | SD |
| Sulphur | 74.68 | 86.35 | 86.35 | 86.35 | 74.68 | 5 | 81.68 | 6.39 |
| Mixed | 115.51 | 114.46 | 115.51 | 125.51 | 114.46 | 5 | 117.09 | 4.74 |
| Peroxide | 89.11 | 86.35 | 86.35 | 89.11 | 86.35 | 5 | 87.45 | 1.51 |
| Compatibilizer | 64.82 | 53.20 | 53.20 | 53.20 | 53.20 | 5 | 55.52 | 5.20 |
| Without vulcanizing agent | 50.03 | 47.80 | 50.03 | 47.80 | 50.03 | 5 | 49.14 | 1.22 |

**Table A.4** Notch-Izod Impact Strength of RTR/PP Blends at 60/40 and Using Peroxide Vulcanizing Agent.

| | Notch-Izod Impact Strength (Kg-cm)/cm notch | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vulcanizing agent | 1st | 2nd | 3rd | 4th | 5th | Data | X | SD |
| Sulphur | 41.01 | 45.87 | 40.74 | 45.87 | 45.87 | 5 | 43.87 | 2.74 |
| Mixed | 53.23 | 53.23 | 56.11 | 56.12 | 56.11 | 5 | 54.96 | 1.58 |
| Peroxide | 102.50 | 102.50 | 103.09 | 102.50 | 103.09 | 5 | 102.74 | 0.32 |
| Compatibilizer | 67.86 | 67.86 | 69.49 | 69.49 | 69.49 | 5 | 68.84 | 0.89 |
| Without vulcanizing agent | 25.24 | 30.13 | 25.24 | 30.13 | 30.13 | 5 | 28.17 | 2.68 |

# APPENDIX B

## Tensile Strength of RTR/Polyolefin Blends

**Table B.1** Tensile Strength of RTR/HDPE Blends at 50/50 and Using Sulphur Vulcanizing Agent.

| | Tensile Strength (MPa) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vulcanizing agent | 1st | 2nd | 3rd | 4th | 5th | Data | X | SD |
| Sulphur | 10.21 | 10.87 | 9.23 | 9.51 | 10.15 | 5 | 9.99 | 0.64 |
| Mixed | 8.5 | 8.6 | 8.9 | 10.21 | 8.9 | 5 | 9.02 | 0.69 |
| Peroxide | 8.35 | 7.76 | 8.18 | 8.25 | 8.12 | 5 | 8.13 | 0.22 |
| Compatibilizer | 7.63 | 7.49 | 7.44 | 7.56 | 7.42 | 5 | 7.51 | 0.09 |
| Without vulcanizing agent | 7.4 | 6.4 | 7.69 | 7.49 | 7.3 | 5 | 7.26 | 0.50 |

**Table B.2** Tensile Strength of RTR/LDPE Blends at 50/50 and Using Mixed Vulcanizing Agent.

| | Tensile Strength (MPa) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vulcanizing agent | 1st | 2nd | 3rd | 4th | 5th | Data | X | SD |
| Sulphur | 4.11 | 4.19 | 4.17 | 4.20 | 4.64 | 5 | 4.26 | 0.22 |
| Mixed | 5.21 | 5.22 | 5.09 | 5.08 | 5.10 | 5 | 5.14 | 0.07 |
| Peroxide | 4.68 | 4.85 | 4.50 | 4.75 | 4.80 | 5 | 4.72 | 0.14 |
| Compatibilizer | 4.60 | 4.72 | 4.33 | 4.48 | 4.36 | 5 | 4.50 | 0.17 |
| Without vulcanizing agent | 4.51 | 4.28 | 3.79 | 4.10 | 3.94 | 5 | 4.12 | 0.28 |

**Table B.3** Tensile Strength of RTR/LLDPE Blends at 50/50 and Using Mixed Vulcanizing Agent.

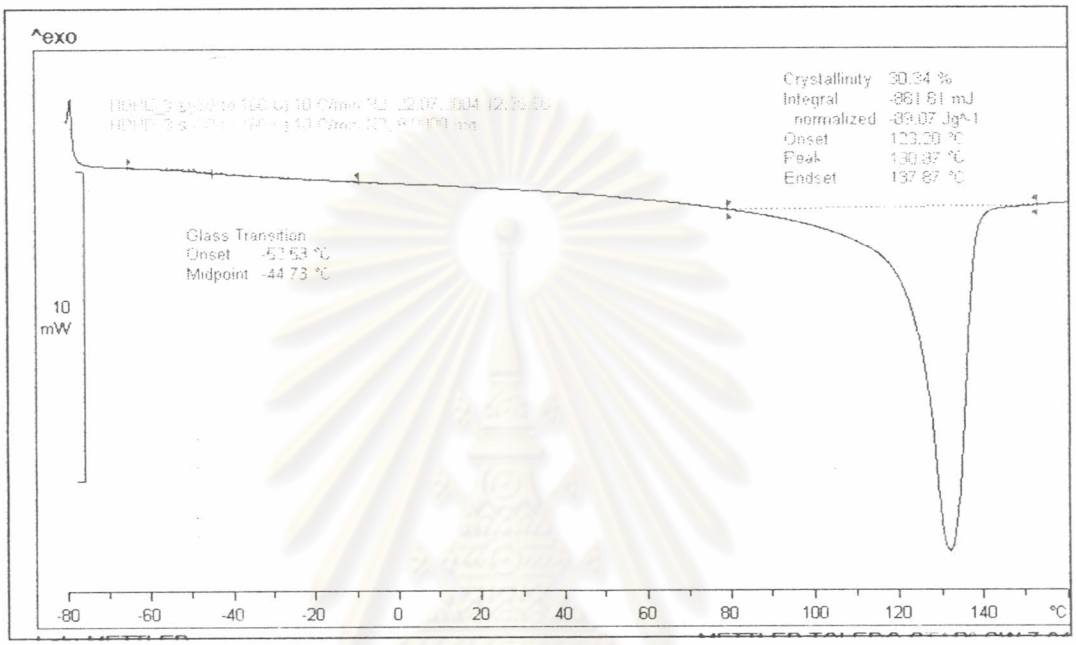
| | Tensile Strength (MPa) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vulcanizing agent | 1st | 2nd | 3rd | 4th | 5th | Data | X | SD |
| Sulphur | 7.03 | 7.76 | 8.66 | 9.87 | 8.86 | 5 | 8.44 | 1.09 |
| Mixed | 11.62 | 11.89 | 11.04 | 10.67 | 12.41 | 5 | 11.53 | 0.69 |
| Peroxide | 8.90 | 8.42 | 8.90 | 8.90 | 8.80 | 5 | 8.79 | 0.21 |
| Compatibilizer | 6.56 | 7.30 | 6.59 | 6.29 | 6.01 | 5 | 6.55 | 0.48 |
| Without vulcanizing agent | 5.93 | 5.96 | 6.25 | 6.70 | 6.04 | 5 | 6.18 | 0.32 |

**Table B.4** Tensile Strength of RTR/PP Blends at 60/40 and Using Peroxide Vulcanizing Agent.

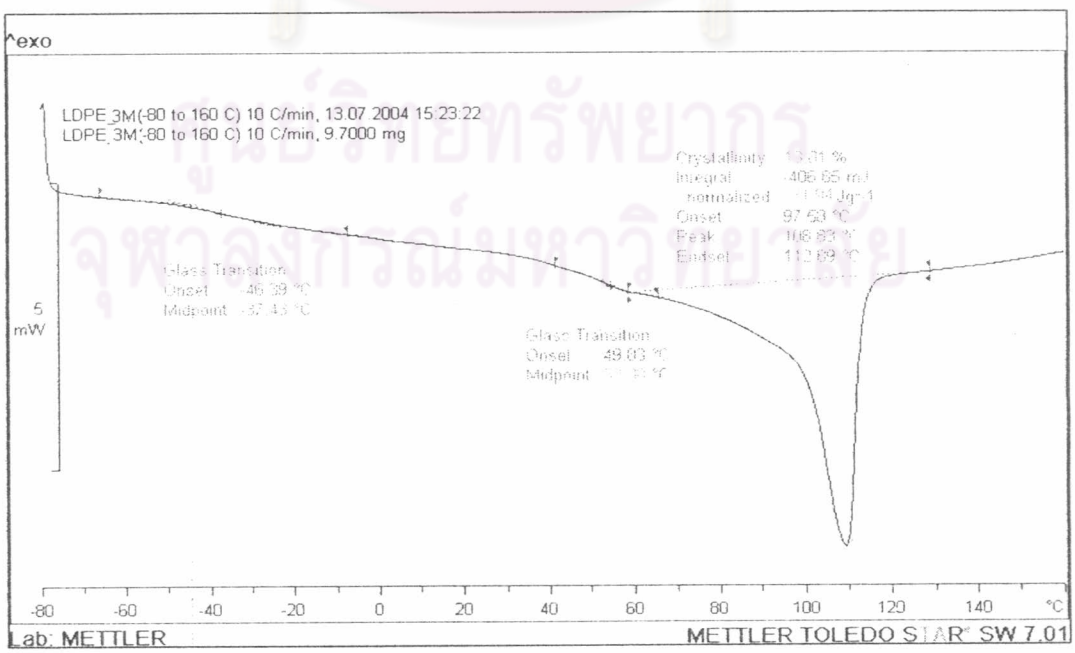
| | Tensile Strength (MPa) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vulcanizing agent | 1st | 2nd | 3rd | 4th | 5th | Data | X | SD |
| Sulphur | 8.03 | 7.60 | 8.57 | 8.62 | 9.18 | 5 | 8.40 | 0.60 |
| Mixed | 8.82 | 8.31 | 8.13 | 9.41 | 9.66 | 5 | 8.87 | 0.67 |
| Peroxide | 11.45 | 12.53 | 10.83 | 12.68 | 12.11 | 5 | 11.92 | 0.78 |
| Compatibilizer | 9.71 | 9.03 | 10.43 | 9.15 | 8.94 | 5 | 9.45 | 0.63 |
| Without vulcanizing agent | 7.03 | 7.77 | 8.67 | 8.75 | 8.86 | 5 | 8.22 | 0.79 |

# APPENDIX C

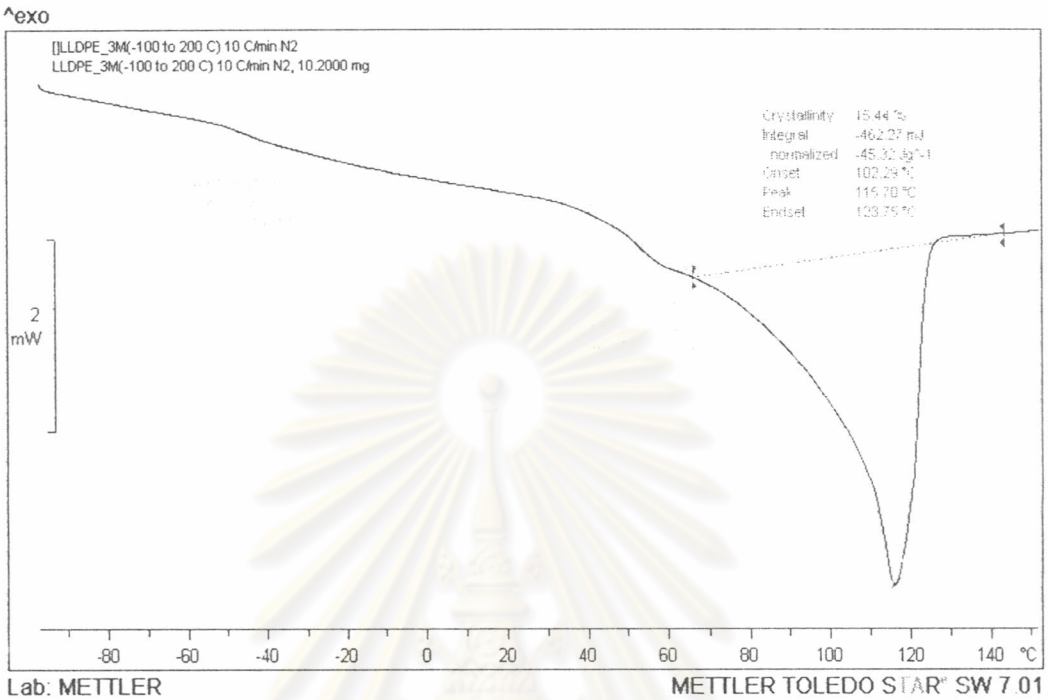
## C.1 DSC thermograms of RTR/HDPE blends at 50/50 and using sulphur vulcanizing agent.



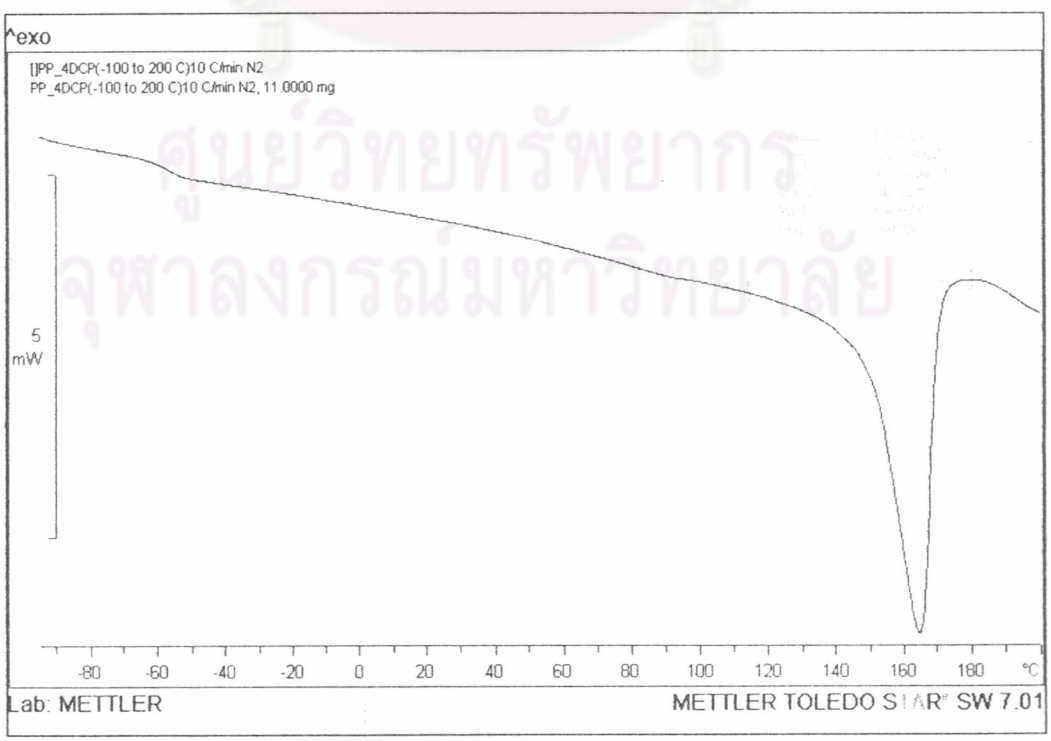

## C.2 DSC thermograms of RTR/LDPE blends at 50/50 and using mix vulcanizing agent.



## C.3 DSC thermograms of RTR/LLDPE blends at 50/50 and using mix vulcanizing agent.




## D. DSC thermograms of RTR/PP blends at 60/40 and using peroxide vulcanizing agent.



# APPENDIX D

## Rheological Behavior of RTR/HDPE Blends.

**Table D.1** Rheological Behavior of RTR/HDPE Blends with Sulphur Vulcanizing Agent.

| freq(rad/s) | G'(Pa) | G''(Pa) | Tan Delta | (Eta)(Pa-s) |
|---|---|---|---|---|
| 0.1 | 4564.9 | 2351.9 | 3.3997 | 74564 |
| 0.15849 | 6430 | 3247.6 | 3.4631 | 59982 |
| 0.25119 | 8138.3 | 4675.4 | 3.7792 | 51298 |
| 0.39811 | 10473 | 6646.3 | 3.4085 | 40414 |
| 0.63096 | 13364 | 9528.5 | 3.2135 | 32987 |
| 1 | 17264 | 13584 | 2.9362 | 27454 |
| 1.5849 | 23150 | 19060 | 2.6723 | 21010 |
| 2.5119 | 29402 | 26636 | 2.4818 | 17747 |
| 3.9811 | 36735 | 36775 | 2.1908 | 14494 |
| 6.3096 | 48329 | 49543 | 1.9404 | 12054 |
| 10 | 62399 | 65847 | 1.7162 | 9687 |
| 15.849 | 80483 | 84784 | 1.5078 | 7154 |
| 25.119 | 99331 | 1.07E+05 | 1.3267 | 5751 |
| 39.811 | 1.23E+05 | 1.30E+05 | 1.167 | 4652 |
| 63.096 | 1.61E+05 | 1.55E+05 | 1.0268 | 3428.7 |
| 100 | 2.09E+05 | 1.79E+05 | 0.89124 | 2689.4 |
| 158.49 | 2.62E+05 | 1.96E+05 | 0.74972 | 2063.3 |
| 251.19 | 3.29E+05 | 1.94E+05 | 0.5881 | 1519.9 |
| 398.11 | 3.61E+05 | 1.26E+05 | 0.34939 | 961.38 |

**Table D.2** Rheological Behavior of RTR/HDPE Blends with Mixed Vulcanizing gent Agent.

| freq(rad/s) | G'(Pa) | G''(Pa) | Tan Delta | (Eta)(Pa-s) |
|---|---|---|---|---|
| 0.1 | 1970.6 | 4069.3 | 2.065 | 45213 |
| 0.15849 | 2746.9 | 5459.7 | 1.9876 | 38563 |
| 0.25119 | 3799.8 | 7364.1 | 1.938 | 32990 |
| 0.39811 | 5253.2 | 9971.7 | 1.8982 | 28311 |
| 0.63096 | 7310.1 | 13435 | 1.8379 | 24242 |
| 1 | 10229 | 17994 | 1.7592 | 20698 |
| 1.5849 | 14327 | 23896 | 1.6679 | 17580 |
| 2.5119 | 20099 | 31430 | 1.5638 | 14852 |
| 3.9811 | 27997 | 40733 | 1.4549 | 12415 |
| 6.3096 | 38731 | 52035 | 1.3435 | 10281 |
| 10 | 53178 | 65619 | 1.2339 | 8446.2 |
| 15.849 | 71763 | 80891 | 1.1272 | 6822.9 |
| 25.119 | 95351 | 97651 | 1.0241 | 5433.5 |
| 39.811 | 1.24E+05 | 1.15E+05 | 0.929 | 4239.6 |
| 63.096 | 1.59E+05 | 1.33E+05 | 0.83415 | 3289.6 |
| 100 | 2.02E+05 | 1.49E+05 | 0.74155 | 2509 |
| 158.49 | 2.51E+05 | 1.60E+05 | 0.63762 | 1877.9 |
| 251.19 | 3.03E+05 | 1.53E+05 | 0.50526 | 1351.5 |
| 398.11 | 3.21E+05 | 94896 | 0.29562 | 840.82 |

**Table D.3** Rheological Behavior of RTR/HDPE Blends with Compatibilizer Vulcanizing Agent.

| freq(rad/s) | G'(Pa) | G''(Pa) | Tan Delta | (Eta)(Pa-s) |
|---|---|---|---|---|
| 0.1 | 5894.8 | 4337.6 | 0.73583 | 67541 |
| 0.15849 | 7742.5 | 4990.6 | 0.64457 | 56214 |
| 0.25119 | 8649.1 | 5720.6 | 0.66141 | 41283 |
| 0.39811 | 10122 | 6977.3 | 0.68933 | 30881 |
| 0.63096 | 11964 | 9336.6 | 0.78042 | 24052 |
| 1 | 14346 | 11957 | 0.83349 | 18676 |
| 1.5849 | 17227 | 14434 | 0.83785 | 14180 |
| 2.5119 | 21072 | 18963 | 0.89988 | 11286 |
| 3.9811 | 26039 | 23484 | 0.90185 | 8807.8 |
| 6.3096 | 32439 | 28929 | 0.89178 | 6888.7 |
| 10 | 40341 | 34960 | 0.86662 | 5338.1 |
| 15.849 | 50123 | 42079 | 0.83952 | 4129.2 |
| 25.119 | 62043 | 48847 | 0.78732 | 3143.6 |
| 39.811 | 75989 | 58260 | 0.76669 | 2405.2 |
| 63.096 | 92765 | 67145 | 0.72381 | 1815 |
| 100 | 1.14E+05 | 74436 | 0.65504 | 1358.5 |
| 158.49 | 1.36E+05 | 82184 | 0.60463 | 1002.2 |
| 251.19 | 1.62E+05 | 82382 | 0.50721 | 725.03 |
| 398.11 | 1.71E+05 | 57589 | 0.33637 | 453.73 |

**Table D.4** Rheological Behavior of RTR/HDPE Blends with Peroxide Vulcanizing agent.

| freq(rad/s) | G'(Pa) | G''(Pa) | Tan Delta | (Eta)(Pa-s) |
|---|---|---|---|---|
| 0.1 | 691.79 | 5631.1 | 1.2336 | 24515 |
| 0.15849 | 937.76 | 6756.9 | 1.0508 | 21328 |
| 0.25119 | 1237.1 | 8384.9 | 1.0303 | 19254 |
| 0.39811 | 1949.9 | 10297 | 0.98318 | 17398 |
| 0.63096 | 2965.2 | 12560 | 0.93987 | 15816 |
| 1 | 4626.3 | 15264 | 0.90515 | 14350 |
| 1.5849 | 7132.5 | 18411 | 0.87048 | 12841 |
| 2.5119 | 10732 | 22124 | 0.83796 | 9875 |
| 3.9811 | 16786 | 26431 | 0.80743 | 8042 |
| 6.3096 | 25533 | 31333 | 0.77693 | 6441 |
| 10 | 38367 | 36980 | 0.74859 | 5120 |
| 15.849 | 56228 | 43373 | 0.7171 | 4104 |
| 25.119 | 73197 | 50326 | 0.68755 | 3236 |
| 39.811 | 88116 | 57902 | 0.65711 | 2648.5 |
| 63.096 | 1.06E+05 | 66019 | 0.62536 | 1973.4 |
| 100 | 1.25E+05 | 74107 | 0.5908 | 1456.9 |
| 158.49 | 1.47E+05 | 79934 | 0.5435 | 1056.2 |
| 251.19 | 1.71E+05 | 78737 | 0.46157 | 747.96 |
| 398.11 | 1.76E+05 | 53331 | 0.30352 | 461.23 |

**Table D.5** Rheological Behavior of RTR/HDPE Blends with Without Vulcanizing Agent.

| freq(rad/s) | G'(Pa) | G''(Pa) | Tan Delta | (Eta)(Pa-s) |
|---|---|---|---|---|
| 0.1 | 556.22 | 1485.4 | 2.6706 | 15861 |
| 0.15849 | 837.72 | 2112.7 | 2.522 | 14340 |
| 0.25119 | 1274.3 | 3000.9 | 2.355 | 12979 |
| 0.39811 | 1856 | 4223.2 | 2.2755 | 11587 |
| 0.63096 | 2749.6 | 5812.3 | 2.1139 | 10191 |
| 1 | 3902.1 | 7983.2 | 2.0459 | 8885.8 |
| 1.5849 | 5842.2 | 10797 | 1.848 | 7745.6 |
| 2.5119 | 8638.3 | 14349 | 1.6611 | 6667.8 |
| 3.9811 | 12340 | 18521 | 1.5008 | 5590.4 |
| 6.3096 | 17315 | 23728 | 1.3704 | 4655.5 |
| 10 | 23914 | 29872 | 1.2492 | 3826.5 |
| 15.849 | 32791 | 36228 | 1.1048 | 3083.2 |
| 25.119 | 43063 | 44166 | 1.0256 | 2455.7 |
| 39.811 | 56511 | 52270 | 0.92496 | 1933.6 |
| 63.096 | 72346 | 61954 | 0.85636 | 1509.6 |
| 100 | 91340 | 72022 | 0.7885 | 1163.2 |
| 158.49 | 1.14E+05 | 80459 | 0.7083 | 878.31 |
| 251.19 | 1.38E+05 | 82445 | 0.59906 | 638.68 |
| 398.11 | 1.50E+05 | 61486 | 0.4111 | 406.19 |

# APPENDIX E

## Rheological Behavior of RTR/LDPE Blends.

**Table E.1** Rheological Behavior of RTR/LDPE Blends with Sulphur Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 174 | 509 | 2.92 | 5,381 |
| 0.16 | 289 | 781 | 2.70 | 5,255 |
| 0.25 | 450 | 1,105 | 2.80 | 4,671 |
| 0.40 | 595 | 1,630 | 2.74 | 4,358 |
| 0.63 | 897 | 2,355 | 2.62 | 3,994 |
| 1.00 | 1,411 | 3,349 | 2.37 | 3,634 |
| 1.58 | 2,174 | 4,660 | 2.14 | 3,245 |
| 2.51 | 3,299 | 6,326 | 1.92 | 2,840 |
| 3.98 | 4,977 | 8,409 | 1.69 | 2,454 |
| 6.31 | 7,348 | 10,904 | 1.48 | 2,084 |
| 10.00 | 10,506 | 13,867 | 1.32 | 1,740 |
| 15.85 | 14,607 | 17,230 | 1.18 | 1,425 |
| 25.12 | 19,771 | 21,082 | 1.07 | 1,151 |
| 39.81 | 26,058 | 25,377 | 0.97 | 914 |
| 63.10 | 33,543 | 30,200 | 0.90 | 715 |
| 100.00 | 42,444 | 35,603 | 0.84 | 554 |

**Table E.2** Rheological Behavior of RTR/LDPE Blends with Mixed Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 350 | 705 | 2.86 | 7,471 |
| 0.16 | 490 | 1,153 | 2.50 | 7,836 |
| 0.25 | 768 | 1,684 | 2.19 | 7,368 |
| 0.40 | 1,066 | 2,343 | 2.20 | 6,466 |
| 0.63 | 1,579 | 3,232 | 2.05 | 5,700 |
| 1.00 | 2,326 | 4,434 | 1.91 | 5,007 |
| 1.58 | 3,360 | 6,010 | 1.79 | 4,344 |
| 2.51 | 4,869 | 8,022 | 1.65 | 3,736 |
| 3.98 | 7,084 | 10,431 | 1.47 | 3,167 |
| 6.31 | 10,054 | 13,368 | 1.33 | 2,651 |
| 10.00 | 13,988 | 16,761 | 1.20 | 2,183 |
| 15.85 | 19,045 | 20,593 | 1.08 | 1,770 |
| 25.12 | 25,308 | 24,877 | 0.98 | 1,413 |
| 39.81 | 32,808 | 29,568 | 0.90 | 1,126 |
| 63.10 | 41,766 | 34,759 | 0.83 | 914 |
| 100.00 | 52,092 | 40,417 | 0.78 | 732 |

**Table E.3** Rheological Behavior of RTR/LDPE Blends with Compatibilizer Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 224 | 543 | 2.43 | 5,870 |
| 0.16 | 352 | 833 | 2.36 | 5,708 |
| 0.25 | 522 | 1,221 | 2.34 | 5,288 |
| 0.40 | 718 | 1,764 | 2.46 | 4,784 |
| 0.63 | 1,127 | 2,410 | 2.14 | 4,217 |
| 1.00 | 1,633 | 3,360 | 2.06 | 3,736 |
| 1.58 | 2,445 | 4,647 | 1.90 | 3,313 |
| 2.51 | 3,586 | 6,195 | 1.73 | 2,850 |
| 3.98 | 5,239 | 8,195 | 1.56 | 2,484 |
| 6.31 | 7,573 | 10,493 | 1.39 | 2,183 |
| 10.00 | 10,634 | 13,219 | 1.24 | 1,899 |
| 15.85 | 14,592 | 16,294 | 1.12 | 1,623 |
| 25.12 | 19,465 | 19,760 | 1.02 | 1,364 |
| 39.81 | 25,400 | 23,572 | 0.93 | 1,109 |
| 63.10 | 32,391 | 27,829 | 0.86 | 861 |
| 100.00 | 40,591 | 32,602 | 0.80 | 659 |

**Table E.4** Rheological Behavior of RTR/LDPE Blends with Peroxide Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 215 | 598 | 2.79 | 6,355 |
| 0.16 | 349 | 897 | 2.57 | 6,073 |
| 0.25 | 530 | 1,317 | 2.49 | 5,652 |
| 0.40 | 752 | 1,781 | 2.37 | 4,856 |
| 0.63 | 1,049 | 2,491 | 2.37 | 4,284 |
| 1.00 | 1,507 | 3,430 | 2.28 | 3,746 |
| 1.58 | 2,150 | 4,749 | 2.21 | 3,289 |
| 2.51 | 3,051 | 6,482 | 2.12 | 2,852 |
| 3.98 | 4,473 | 8,877 | 1.98 | 2,497 |
| 6.31 | 6,580 | 11,941 | 1.81 | 2,161 |
| 10.00 | 9,625 | 15,824 | 1.64 | 1,852 |
| 15.85 | 13,935 | 20,618 | 1.48 | 1,570 |
| 25.12 | 19,755 | 26,419 | 1.34 | 1,313 |
| 39.81 | 27,373 | 33,196 | 1.21 | 1,081 |
| 63.10 | 37,112 | 40,971 | 1.10 | 876 |
| 100.00 | 49,353 | 49,846 | 1.01 | 701 |

**Table E.5** Rheological Behavior of RTR/LDPE Blends without Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 120 | 485 | 4.96 | 4,948 |
| 0.16 | 198 | 782 | 3.94 | 5,089 |
| 0.25 | 310 | 1,158 | 2.98 | 4,862 |
| 0.40 | 510 | 1,633 | 3.20 | 4,298 |
| 0.63 | 770 | 2,317 | 3.01 | 3,870 |
| 1.00 | 1,072 | 3,274 | 3.05 | 3,446 |
| 1.58 | 1,660 | 4,650 | 2.80 | 3,116 |
| 2.51 | 2,544 | 6,537 | 2.57 | 2,793 |
| 3.98 | 3,961 | 9,059 | 2.29 | 2,443 |
| 6.31 | 6,117 | 12,342 | 2.02 | 2,051 |
| 10.00 | 9,308 | 16,552 | 1.78 | 1,697 |
| 15.85 | 13,791 | 21,711 | 1.57 | 1,380 |
| 25.12 | 19,960 | 27,847 | 1.40 | 1,104 |
| 39.81 | 27,994 | 35,033 | 1.25 | 870 |
| 63.10 | 38,307 | 43,141 | 1.13 | 677 |
| 100.00 | 51,179 | 52,277 | 1.02 | 521 |

# APPENDIX F

## Rheological Behavior of RTR/LLDPE Blends.

**Table F.1** Rheological Behavior of RTR/LLDPE Blends with Sulphur Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 5,619 | 4,798 | 0.85 | 73,887 |
| 0.16 | 6,631 | 6,142 | 0.93 | 57,031 |
| 0.25 | 8,682 | 7,557 | 0.87 | 45,824 |
| 0.40 | 10,578 | 9,559 | 0.90 | 35,812 |
| 0.63 | 12,883 | 12,384 | 0.96 | 28,322 |
| 1.00 | 15,963 | 15,889 | 1.00 | 22,523 |
| 1.58 | 20,088 | 20,785 | 1.03 | 18,238 |
| 2.51 | 25,639 | 26,782 | 1.04 | 14,760 |
| 3.98 | 32,954 | 34,187 | 1.04 | 11,927 |
| 6.31 | 42,592 | 43,195 | 1.01 | 9,614 |
| 10.00 | 55,566 | 53,951 | 0.97 | 7,745 |
| 15.85 | 72,554 | 66,581 | 0.92 | 6,213 |
| 25.12 | 94,427 | 80,527 | 0.85 | 4,941 |
| 39.81 | 122,150 | 95,808 | 0.78 | 3,900 |
| 63.10 | 155,890 | 111,350 | 0.71 | 3,036 |

**Table F.2** Rheological Behavior of RTR/LLDPE Blends with Mixed Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 16,779 | 8,506 | 0.51 | 188,120 |
| 0.16 | 18,423 | 10,310 | 0.56 | 133,210 |
| 0.25 | 21,126 | 12,074 | 0.57 | 96,869 |
| 0.40 | 24,273 | 14,527 | 0.60 | 71,056 |
| 0.63 | 28,024 | 17,702 | 0.63 | 52,534 |
| 1.00 | 32,928 | 22,032 | 0.67 | 39,619 |
| 1.58 | 39,449 | 26,737 | 0.68 | 30,069 |
| 2.51 | 46,874 | 33,152 | 0.71 | 22,856 |
| 3.98 | 58,881 | 40,646 | 0.69 | 17,972 |
| 6.31 | 70,276 | 49,901 | 0.71 | 13,660 |
| 10.00 | 86,091 | 60,583 | 0.70 | 10,527 |
| 15.85 | 106,280 | 72,902 | 0.69 | 8,132 |
| 25.12 | 131,350 | 86,478 | 0.66 | 6,261 |
| 39.81 | 162,480 | 100,690 | 0.62 | 4,801 |
| 63.10 | 198,400 | 115,590 | 0.58 | 3,639 |
| 100.00 | 240,080 | 130,680 | 0.54 | 2,733 |

**Table F.3** Rheological Behavior of RTR/LLDPE Blends with Compatibilizer Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 3,526 | 1,782 | 0.51 | 39,510 |
| 0.16 | 4,030 | 2,266 | 0.56 | 29,174 |
| 0.25 | 4,683 | 2,767 | 0.59 | 21,654 |
| 0.40 | 5,188 | 3,678 | 0.71 | 15,974 |
| 0.63 | 5,797 | 4,813 | 0.83 | 11,941 |
| 1.00 | 7,068 | 6,315 | 0.89 | 9,478 |
| 1.58 | 8,943 | 8,338 | 0.93 | 7,715 |
| 2.51 | 11,237 | 10,479 | 0.93 | 6,117 |
| 3.98 | 14,062 | 13,366 | 0.95 | 4,873 |
| 6.31 | 17,992 | 16,697 | 0.93 | 3,890 |
| 10.00 | 22,765 | 20,339 | 0.89 | 3,237 |
| 15.85 | 29,414 | 24,758 | 0.84 | 2,558 |
| 25.12 | 36,565 | 29,751 | 0.81 | 2,003 |
| 39.81 | 45,543 | 34,934 | 0.77 | 1,556 |
| 63.10 | 56,078 | 40,851 | 0.73 | 1,199 |

**Table F.4** Rheological Behavior of RTR/LLDPE Blends with Peroxide Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 7,894 | 13,629 | 0.47 | 98,764 |
| 0.16 | 8,945 | 14,547 | 0.45 | 79,854 |
| 0.25 | 10,141 | 15,886 | 0.43 | 62,348 |
| 0.40 | 12,478 | 17,771 | 0.43 | 50,246 |
| 0.63 | 15,885 | 18,965 | 0.42 | 36,548 |
| 1.00 | 18,958 | 20,153 | 0.42 | 27,841 |
| 1.58 | 23,287 | 21,906 | 0.41 | 22,548 |
| 2.51 | 29,841 | 24,015 | 0.41 | 17,414 |
| 3.98 | 36,942 | 26,312 | 0.41 | 13,001 |
| 6.31 | 47,841 | 28,844 | 0.42 | 10,874 |
| 10.00 | 62,934 | 31,904 | 0.44 | 8,047 |
| 15.85 | 80,145 | 36,236 | 0.45 | 6,512 |
| 25.12 | 95,574 | 40,185 | 0.47 | 5,214 |
| 39.81 | 124,875 | 43,793 | 0.49 | 4,100 |
| 63.10 | 165,497 | 47,868 | 0.50 | 3,216 |

**Table F.5** Rheological Behavior of RTR/LLDPE Blends without Vulcanzing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 3,070 | 1,442 | 0.47 | 33,914 |
| 0.16 | 3,410 | 2,226 | 0.65 | 25,694 |
| 0.25 | 3,955 | 2,868 | 0.73 | 19,448 |
| 0.40 | 4,536 | 3,785 | 0.83 | 14,840 |
| 0.63 | 5,440 | 5,070 | 0.93 | 11,785 |
| 1.00 | 6,682 | 6,663 | 1.00 | 9,436 |
| 1.58 | 8,474 | 8,724 | 1.03 | 7,674 |
| 2.51 | 10,718 | 11,483 | 1.07 | 6,253 |
| 3.98 | 13,830 | 14,417 | 1.04 | 5,018 |
| 6.31 | 17,979 | 18,106 | 1.01 | 4,044 |
| 10.00 | 23,334 | 22,440 | 0.96 | 3,053 |
| 15.85 | 29,936 | 27,331 | 0.91 | 2,426 |
| 25.12 | 38,097 | 32,850 | 0.86 | 1,877 |
| 39.81 | 48,011 | 39,159 | 0.82 | 1,442 |
| 63.10 | 59,950 | 46,193 | 0.77 | 1,100 |
| 100.00 | 73,542 | 53,847 | 0.73 | 835 |

# APPENDIX G

## Rheological Behavior of RTR/PP Blends.

**Table G.1** Rheological Behavior of RTR/PP Blends with Mix Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 1,131 | 1,594 | 1.41 | 15,424 |
| 0.16 | 1,766 | 2,037 | 1.15 | 12,471 |
| 0.25 | 2,386 | 2,598 | 1.09 | 10,258 |
| 0.40 | 3,124 | 3,377 | 1.08 | 8,895 |
| 0.63 | 4,020 | 4,229 | 1.05 | 7,386 |
| 1.00 | 5,242 | 5,204 | 0.99 | 5,903 |
| 1.58 | 6,806 | 6,419 | 0.94 | 4,606 |
| 2.51 | 8,592 | 7,749 | 0.90 | 3,620 |
| 3.98 | 11,034 | 9,274 | 0.84 | 2,790 |
| 6.31 | 13,944 | 10,742 | 0.77 | 2,133 |
| 10.00 | 17,368 | 12,385 | 0.71 | 1,745 |
| 15.85 | 21,267 | 14,005 | 0.66 | 1,389 |
| 25.12 | 25,651 | 15,640 | 0.61 | 1,050 |
| 39.81 | 30,480 | 17,325 | 0.57 | 771 |
| 63.10 | 35,794 | 19,137 | 0.53 | 556 |
| 100.00 | 41,339 | 21,151 | 0.51 | 420 |

**Table G.2** Rheological Behavior of RTR/PP Blends with Peroxide Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 1,655 | 2,504 | 2.08 | 16,427 |
| 0.16 | 2,558 | 3,426 | 2.07 | 14,085 |
| 0.25 | 3,546 | 4,811 | 1.88 | 11,897 |
| 0.40 | 5,190 | 6,481 | 1.83 | 9,417 |
| 0.63 | 7,444 | 8,687 | 1.67 | 8,054 |
| 1.00 | 10,653 | 11,413 | 1.53 | 6,237 |
| 1.58 | 14,927 | 14,795 | 1.39 | 5,047 |
| 2.51 | 20,647 | 18,746 | 1.26 | 4,001 |
| 3.98 | 27,924 | 23,108 | 1.12 | 3,050 |
| 6.31 | 37,083 | 28,073 | 1.01 | 2,556 |
| 10.00 | 48,569 | 33,123 | 0.89 | 1,981 |
| 15.85 | 62,331 | 38,453 | 0.79 | 1,500 |
| 25.12 | 78,109 | 43,639 | 0.70 | 1,104 |
| 39.81 | 95,484 | 48,416 | 0.62 | 821 |
| 63.10 | 114,520 | 52,520 | 0.55 | 550 |
| 100.00 | 135,987 | 55,839 | 0.49 | 410 |

**Table G.3** Rheological Behavior of RTR/PP Blends with Sulphur Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 1,084 | 1,581 | 1.46 | 19,171 |
| 0.16 | 1,483 | 2,001 | 1.35 | 15,717 |
| 0.25 | 2,216 | 2,769 | 1.25 | 14,119 |
| 0.40 | 2,961 | 3,425 | 1.16 | 11,373 |
| 0.63 | 3,965 | 4,278 | 1.08 | 9,244 |
| 1.00 | 5,119 | 5,351 | 1.05 | 7,405 |
| 1.58 | 6,762 | 6,444 | 0.95 | 5,893 |
| 2.51 | 8,710 | 7,825 | 0.90 | 4,661 |
| 3.98 | 11,086 | 9,082 | 0.82 | 3,600 |
| 6.31 | 13,946 | 10,529 | 0.76 | 2,769 |
| 10.00 | 17,288 | 11,998 | 0.69 | 2,104 |
| 15.85 | 21,054 | 13,535 | 0.64 | 1,579 |
| 25.12 | 25,217 | 15,073 | 0.60 | 1,170 |
| 39.81 | 29,868 | 16,683 | 0.56 | 859 |
| 63.10 | 34,894 | 18,409 | 0.53 | 625 |
| 100.00 | 40,265 | 20,283 | 0.50 | 451 |

**Table G.4** Rheological Behavior of RTR/PP Blends with Compatibilizer Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 1,355 | 2,551 | 1.88 | 28,881 |
| 0.16 | 2,058 | 3,353 | 1.63 | 24,826 |
| 0.25 | 2,620 | 4,733 | 1.81 | 21,538 |
| 0.40 | 3,914 | 6,401 | 1.64 | 18,846 |
| 0.63 | 4,487 | 8,181 | 1.52 | 15,518 |
| 1.00 | 5,887 | 10,751 | 1.37 | 13,296 |
| 1.58 | 7,899 | 13,636 | 1.30 | 10,864 |
| 2.51 | 10,748 | 17,237 | 1.20 | 8,932 |
| 3.98 | 12,374 | 21,373 | 1.09 | 7,280 |
| 6.31 | 15,362 | 25,910 | 0.98 | 5,852 |
| 10.00 | 19,577 | 30,636 | 0.88 | 4,642 |
| 15.85 | 26,310 | 35,461 | 0.78 | 3,635 |
| 25.12 | 34,869 | 40,185 | 0.69 | 2,815 |
| 39.81 | 45,413 | 44,468 | 0.61 | 2,150 |
| 63.10 | 58,185 | 48,215 | 0.54 | 1,613 |
| 100.00 | 73,124 | 51,099 | 0.48 | 1,189 |

**Table G.5** Rheological Behavior of RTR/PP Blends Without Vulcanizing Agent.

| Freq(rad/s) | G'[Pa] | G"[Pa] | Tan delta | ETA[Pa.s] |
|---|---|---|---|---|
| 0.10 | 762 | 1,003 | 1.32 | 12,593 |
| 0.16 | 947 | 1,233 | 1.30 | 9,808 |
| 0.25 | 1,189 | 1,590 | 1.34 | 7,902 |
| 0.40 | 1,616 | 2,063 | 1.28 | 6,582 |
| 0.63 | 2,046 | 2,884 | 1.41 | 5,604 |
| 1.00 | 2,737 | 3,841 | 1.40 | 4,716 |
| 1.58 | 3,642 | 5,037 | 1.38 | 3,652 |
| 2.51 | 4,873 | 6,600 | 1.35 | 2,705 |
| 3.98 | 6,663 | 8,458 | 1.27 | 2,211 |
| 6.31 | 9,108 | 10,563 | 1.16 | 1,793 |
| 10.00 | 12,348 | 12,998 | 1.05 | 1,428 |
| 15.85 | 16,352 | 15,642 | 0.96 | 1,120 |
| 25.12 | 21,278 | 18,393 | 0.86 | 862 |
| 39.81 | 26,946 | 21,279 | 0.79 | 655 |
| 63.10 | 33,457 | 24,243 | 0.72 | 491 |
| 100.00 | 40,784 | 27,406 | 0.67 | 401 |

# APPENDIX H

**Table H.1** Specification of High Density Polyethylene (Polene R 1760).

| Typical Data | Unit | Value | Test Method |
|---|---|---|---|
| MFI 2.16 kg/190°C | g/10 min | 6 | ASTM D 1238 |
| MFI 5 kg/190°C | g/10 min | 18 | ASTM D 1238 |
| Density | $g/cm^3$ | 0.957 | ASTM D 792 |
| Tensile strength | MPa | 29 | ASTM D 638 |
| Ultimate elongation | % | 700 | ASTM D 638 |
| Charpy notched impact strength | $mJ/mm^2$ | 3 | DIN 53453 |
| **Injection molding grade** | | | |

**Table H.2** Specification of Low Density Polyethylene (LD1450J).

| Typical Data | Unit | Value | Test Method |
|---|---|---|---|
| MFI | g/10 min | 50 | ASTM D 1238 |
| Density | $g/cm^3$ | 0.914 | ASTM D 1505 |
| Tensile strength | MPa | 100 | ASTM D 638 |
| Ultimate elongation | % | 100 | ASTM D 638 |
| **Injection molding grade** | | | |

**Table H.3** Specification of Linear Low Density Polyethylene (1221G1).

| Typical Data | Unit | Value | Test Method |
|---|---|---|---|
| MFI | g/10 min | 2 | ASTM D 1238 |
| Density | $g/cm^3$ | 0.918 | ASTM D 792 |
| Film Properties, (25 μm) | | | |
| Tensile strength | MPa | 40 | ASTM D 882 |
| Ultimate elongation | % | 447 | ASTM D 882 |
| **Cast Film Resin grade** | | | |

**Table H.4** Specification of Polypropylene (Moplen HP400K 6531)

| Typical Data | Unit | Value | Test Method |
|---|---|---|---|
| MFI | g/10 min | 4 | ASTM D 1238 |
| Density | $g/cm^3$ | 0.9 | ASTM D 792 |
| Tensile strength | MPa | 33 | ASTM D 638 |
| Ultimate elongation | % | 10 | ASTM D 638 |
| Notch izod impact strength | J/m | 30 | ASTM D 256A |
| **General Purpose Polypropylene Homopolymer Resin grade** | | | |

**Table H.5** Specification of Reclaimed Tire Rubber (Vulcanized Reclaim) Cured at 142°C in the Hydraulic Press.

| Typical Data | Unit | Value | Test Method |
|---|---|---|---|
| Mooney viscosity | ML 1'+4' at100°C | 60 | ASTM D 1646 |
| Specific gravity at 25°C | | 1.14 | |
| Tensile strength | MPa | 6.38 | ASTM D 412 |
| Ultimate elongation | % | 250 | ASTM D 638 |

# VITA

Mr. Panu Punnarak was born on July 22, 1971 in Bangkok. He received a Bachelor's Degree of Science in Chemistry from Kasetsart University in 1993. In 1999, he received a Master's Degree of Science in the Program of Petrochemistry and Polymer Science, Chulalongkorn University. In 2005, He was accepted as a graduate student in the Program of Petrochemistry, Faculty of Science, Chulalongkorn University. He received a degree of Doctor of Philosophy in Petrochemistry.