

**Reusing of Industrial Polymeric Waste
Materials as Fillers in Radiation Vulcanized
Rubber Based Composites**

By

Khaled Farouk Maghawry El Nemr

B.Sc. Faculty of Science, Ain Shams University, 1987

Master in Environmental Sci., Ain Shams University, 1998

**A Thesis Submitted in Partial Fulfillment of the
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صفحة الموافقة على الرسالة

إعادة إستخدام مخلفات بوليمرية صناعية لاستخدامها كمواد مائنة

Abstract

Industrial polymeric waste materials of different kinds and magnitudes are produced as a result of manufacture of various polymeric articles. These kinds of waste materials would be expected to contribute to environmental pollution. Essentially, this investigation is aiming to recycle different kinds of polymeric waste materials, namely polyethylene terephthalate fiber (PET) and polytetrafluoroethylene filled with carbographite (PTFE-CG) as fillers with different elastomers, which have many applications.

The properties of electron beam (EB) vulcanized acrylonitrile-butadiene rubber (NBR) or its blend with polyvinyl chloride (PVC) reinforced by PET fibers were studied. Polyfunctional monomers namely, trimethylol propane triacrylate (TMPTA) as radiation coagent for NBR and pentaerythritol tetraacrylate (PETA) for NBR-PVC, as well as the bonding system Resorcinol / Hexamethylenetetramine / Silica (RHS), to enhance fiber / elastomer adhesion, were used to maintain maximum properties. PET waste fibers were found to enhance the mechanical properties namely, tensile strength, hardness, stiffness and modulus. Moreover, the physico-chemical properties like soluble fraction, swelling in solvent, anisotropic solvent swelling, and volume fraction of swollen rubber were remarkably improved. Also, it was found that the thermal stability of prepared composites was increased, whereas the electrical conductivity was reduced.

The property of EB vulcanized NBR rubber enhanced by PETA and reinforced by 40 phr silica, filled with varying contents of PTFE-CG powder scrap was studied.

It was found that the inclusion of PTFE-CG powder scrap up to 40 phr in NBR rubber resulted in moderate decrease in tensile strength with respect to unloaded ones, while modulus was remarkably improved. The results obtained showed that the prepared composites have low friction coefficient and high abrasion resistance. Also, it was

found that the thermal stability of prepared composites was increased. Moreover, the prepared composites showed good resistance swelling in fuel A (gasoline) at high temperature 100 °C.

Key Words:

Polytetrafluoroethylene- Cabographe, Elctron beam, Bonding system, Polyethylene terephthalate fiber, Friction, Abrasion, Thermal stability, Tensile strength

Contents

	Page
I. INTRODUCTION.....	1
I. 1 Crosslinking reactions.....	2
I. 2 Chemical vulcanization of rubber.....	3
I.3 Polymer curing by radiation.....	4
I.3.1 Types and sources of radiation.....	5
I.3.2 Mechanism of reaction by radiation	6
I.4 Radiation effects on polymers.....	9
I.4.1 Crosslinking and degradation	9
I.5 Particle and fiber reinforced elastomers.....	16
I.6 Effect of bonding agent in short fiber elastomer composites...	16
I.7- Polymer waste problem.....	17
I.7.1 Polyethylene terephthalate waste (PET).....	18
I.7.2 Polytetrafluoroethylene waste (PTFE) & PTFE-CG.....	19
I.8 Basic approaches to recycling and of polymeric materials.....	22
I.8.1 Material recycling.....	22
I.8.2 Chemical recycling.....	23
I.8.3 Incineration.....	24
I.9 The status of radiation-assisted polymer recycling.....	24
I.10 Summary of application of radiation in polymer recycling...	25
II. LITERATURE REVIEW.....	27
II.1 Studies on NBR Rubber.....	27
II.2 Studies on NBR-PVC blends.....	32
II.3 Effect of radiation promoters (Coagents) on the crosslinking of polymers.....	37
II.4 Studies on short fibers reinforced elastomer.....	41
II.5 Irradiated virgin teflon.....	47
II.6 Studies on scrap PTFE.....	52
II.7 Fluoroplastic powder (PTFE) as additive in polymers.....	54
III. MATERIALS AND . TECHNIQUES.....	57
III.1 MATERIALS.....	57
III-1.1 Matrix	57
A: Acrylonitrile butadiene rubber (NBR).....	57
B: Acrylonitrile butadiene rubber / Polyvinyl chloride NBR/PVC blend.....	57
III-1.2 Functional monomers (Coagents).....	58
A: Diethylene glycol diacrylate.....	58
B: Trimethylol propane triacrylate	58
C: Pentaerthritol tetracrylate	59

III.1.3 Bonding system.....	60
Resorcinol.....	60
Hexamethylenetetramine.....	61
Silica (Precipitated)	61
III.1.4 Antioxidant.....	61
III.1.5 Activators.....	62
1- Zinc Oxide.....	62
2- Stearic acid.....	62
III.1.6 Fillers.....	63
1- Polyester Fibers Waste.....	63
2- Polytetrafluoroethylene (PTFE)/Carbographite (CG) waste.....	63
III.2 TECHNIQUES.....	63
III.2.1 Preparation of irradiated pulverized fine powder of waste PTFE-CG scrap.....	64
III.2.2 Preparation of samples.....	64
III.2.3 Irradiation procedure.....	66
III.2.3 MEASUREMENTS.....	66
III.3.1 Mechanical properties.....	66
1- Ultimate tensile strength	67
2- Elongation at break point.....	69
3- Tensile modulus at a given elongation.....	69
4- Young's modulus.....	69
5- Abrasion measurement.....	69
III.3.2 Physico-Chemical measurements	70
1- Soluble fraction.....	70
2- Swelling ratio	71
3- Anisotropic swelling.....	72
4- Volume fraction of swollen rubber.....	73
5- Crosslink density.....	73
III.3.3 Coefficient of friction measurements	74
III.3.4 Hardness measurements.....	76
III.3.5 Thermogravimetric analysis measurements.....	76
III.3.6 Scanning Electron Microscope	77
III.3.7 Particle size analysis measurements	77
III.3.8 Electrical conductivity measurements.....	77
III.3.9 Effect of fuel on NBR composites.....	78
IV. RESULTS AND DISCUSSION.....	80
PART. I	80
IV.1 Effect of polyfunctional monomers on radiation vulcanization of acrylonitrile- butadiene rubber.....	80
IV.1.1 Mechanical properties.....	81

A- Tensile strength	81
B- Tensile modulus at 100 % elongation.....	83
C- Elongation at break point %	85
IV.1.2 Physico-chemical properties.....	87
A- Soluble fraction.....	87
B- Swelling ratio	87
C- Crosslinking density.....	90
D- Volume fraction of swollen NBR rubber.....	92
PART II	94
IV.2 The influence of bonding system on the interfacial adhesion between rubber matrix and PET fibers.....	94
IV.1.1 Mechanical properties.....	95
A- Tensile strength.....	95
B- Tensile modulus at 100 % elongation.....	95
C- Elongation at break point %	98
D- Hardness.....	100
III.3.2 Physico-Chemical properties.....	102
A-Soluble fraction.....	102
B- Swelling ratio	104
C- Volume fraction of swollen NBR rubber.....	104
PART III	107
IV.3 Short polyethylene terephthalate fiber reinforced NBR rubber.....	107
IV.1.4 Effect of fiber concentration on physico-mechanical and physico-chemical properties of NBR rubber composites in presence of bonding system.....	108
IV.3.2 Mechanical properties.....	108
A- Tensile strength	108
B- Elongation at break.....	113
C- Tensile modulus at 25 % elongation.....	115
D- Young's modulus	117
E- Hardness.....	119
III.3.3 Physico-Chemical properties.....	121
A- Soluble fraction.....	121
B- Swelling ratio	123
C-Volume fraction of swollen NBR rubber vulcanizate.....	126
D- Anisotropic swelling.....	126
IV.3.4 Scanning electron microscope study for NBR composites.....	129
IV.3.4.1 Effect of bonding system.....	129
IV.3.4.2 Effect of fiber concentration.....	131

IV.3.4.3 Effect of irradiation dose.....	131
IV.3.5 Thermal analysis studies of NBR composites.....	134
IV.3.5.1 Effect of fiber loading on thermal decomposition of NBR composites at constant irradiation dose.....	134
IV.3.5.2 Effect of irradiation dose on thermal decomposition of NBR at a constant fiber loading.....	139
IV.3.6 Electrical properties of NBR composites.....	144
IV.3.6.1 Voltage-current characteristics.....	144
IV.3.6.2 DC Electrical conductivity.....	150
PART IV	152
IV.4 Short PET fiber-reinforced acrylonitrile butadiene rubber -Polyvinyl chloride (NBR-PVC) composites.....	153
IV.4.1 Effect of fiber concentration on physico-mechanical and physico-chemical properties of NBR-PVC composites in presence of bonding system.....	153
IV.4.2 Mechanical properties.....	153
A- Tensile strength.....	154
B- Elongation at break.....	157
C- Tensile modulus at 25 % elongation.....	165
D- Young's modulus	168
E- Hardness.....	171
III.4.3 Physico-Chemical properties.....	174
A- Soluble fraction.....	174
B- Swelling ratio	176
C- Anisotropic swelling.....	179
D- Volume fraction of swollen NBR-PVC vulcanizate	179
IV.4.4 Scanning electron microscopy of NBR-PVC composites.....	182
IV.4.4.1 Effect of fiber concentration.....	182
IV.4.4.2 Effect of irradiation dose.....	185
IV.4.5 Thermal analysis studies of NBR-PVC composites.....	185
IV.4.5.1 Effect of fiber loading on thermal decomposition of NBR-PVC composites at constant irradiation dose.....	185
IV.4.5.2 Effect of irradiation dose on thermal decomposition of NBR-PVC at a constant fiber loading.....	192
IV.4.6 Electrical properties of NBR-PVC composites.....	197
IV.4.6.1 Voltage-current characteristics.....	197
IV.4.6.2 DC Electrical conductivity.....	201
PART. V	205

IV.5 Radiation vulcanization of acrylonitrile butadiene Rubber filled with polytetrafluoroethylene-carbographite Powder.....	205
IV.5.1 Effect the concentration of PTFE-CG powder on physico- mechanical and physico-chemical properties of NBR composites in presence of silica.....	206
IV.5.2 Physico-mechanical properties.....	207
IV.5.2.1 Mechanical properties.....	207
A- Tensile strength.....	207
B- Elongation at break.....	213
C- Tensile modulus at 100 % elongation.....	219
IV.5.3 Physico-Chemical properties.....	219
A- Soluble fraction.....	219
B- Swelling ratio	224
C-Swollen rubber volume fraction.....	227
IV.5.4 Coefficient of friction measurements.....	229
IV.5.5 Abrasion resistance measurements.....	234
IV.5.6 Scanning electron microscope.....	236
IV.5.6.1 Effect of PTFE-CG powder loading.....	236
IV.5.7 Thermal analysis measurements.....	239
IV.5.7.1 Effect of PTFE-CG powder loading on thermal decomposition of NBR composites at constant irradiation dose.....	239
IV.5.8 Effect of fuels on NBR composites.....	246
SUMMARY AND CONCLUSIONS.....	254
REFERENCES.....	262
ARABIC SUMMARY.....	

List of figures

Fig. (1)	A laboratory plasticorder mixer type 350 S.	65
Fig. (2)	Electron beam accelerator	68
Fig. (3)	Apparatus for determination of coefficient of friction.	75
Fig. (4)	Tensile strength as a function of irradiation dose for NBR rubber enhanced with different polyfunctional monomers.	82
Fig. (5)	Tensile modulus at 100 % elongation as a function of irradiation dose for NBR rubber enhanced with different polyfunctional monomers	84
Fig. (6)	Elongation at break as a function of irradiation dose for NBR rubber enhanced with different polyfunctional monomers .	86
Fig. (7)	Soluble fraction as a function of irradiation dose for NBR enhanced with different polyfunctional monomers .	88
Fig. (8)	Swelling ratio as a function of irradiation dose for NBR enhanced with different polyfunctional monomers .	89
Fig. (9)	The dependence of the number of crosslinked units per unit volume of NBR rubber in presence of different polyfunctional monomers on irradiation dose.	91
Fig. (10)	Effect of irradiation dose on V_r of NBR rubber enhanced with different polyfunctional monomers.	93
Fig. (11A)	Tensile strength as a function of irradiation dose for NBR rubber loaded with 5 phr chopped PET fiber treated and untreated by bonding system.	96
Fig. (11B)	Tensile strength as a function of irradiation dose for NBR rubber loaded with 10 phr chopped PET fiber treated and untreated by bonding system	96
Fig. (12A)	Tensile modulus at 25 % elongation as a function of irradiation dose For NBR rubber loaded with 5 phr chopped PET Fiber treated and untreated by bonding system.	97