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

By

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A Thesis Submitted in Partial Fulfillment of the Requirement for the Doctor of Philosophy

In

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AKNOWLEDGEMENT

I wish to express my greatest thanks to ***Prof. Dr. Abdel Gwad M. Rabie,*** Prof. of Organic Chemistry, Chemistry Dept. Faculty of Science, Ain Shams University, for his encouragement, supervision and helpful discussion throughout the course of this investigation.

I wish to express my sincere esteem and deepest thanks to ***Prof. Dr. Ahmed A. El Miligy***, Prof. of Radiation chemistry, National Center for Radiation Research and Technology (NCRRT), AEA, for his continuous guidance and encouragement during the course of this work as well as his fruitful discussion and help in the final accomplishment of this work.

I wish also to my deep grateful thanks and sincere esteem to ***Prof. Ass. Dr. Hussien Ali Youssef***, Prof. Ass., of polymers and radiation chemistry, NCRRT, AEA, for his valuable help, sincere and continuous guidance during all the stages of this work as well as his fruitful discussion.

My great thanks and deepest gratitude to ***Prof. Ass. Dr. Nawal M. shaltout***, Prof. Ass., of polymers and radiation chemistry, NCRRT, AEA, for her valuable help sincere and continuous guidance during this work.

My deepest thanks are due to **Prof. Ass. Reda M. Radwan,** Radiation Physics Dept. for his help and cooperation in electrical measurements.

Finally, thanks are expressed to the Head of Radiation Chemistry Department, NCRRT, AEA for his continuos encourage. Also, many thanks are due to my colleagues in the department.

إعادة إستخدام مخلفات بوليمرية صناعية لاستخدامها كمواد مالئة فى مترا كبات مطاطية مفلكنة إشعاعيا

رسالة مقدمة من الطالب

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قسم العلوم البيولوجية والطبيعية

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2005

صفحة الموافقة على الرسالة

إعادة إستخدام مخلفات بوليمرية صناعية لاستخدامها كمواد مالئة

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 e;astomers, which have many application.

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 pentaerthritol 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 moderately 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 ^{o}C.

Key Words:

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

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