Soybean oil plasticizers as replacement of petroleum oil in rubber

Polymerized soybean oils of different molecular weights were used as plasticizers in NR/SBR compounds. The oils of different molecular weights and viscosities were synthesized by cationic polymerization using a proprietary technology. Since vegetable oils have double bonds, they are not only viscosity depressants but also active participants in crosslinking reactions. Properties of elastomers extended with different concentrations of mineral oil plasticizer or pure soybean oil were compared with elastomers extended by polymerized oils of different molecular weights at the same concentrations. It was found polymerized soybean oil could be substituted for naphthenic process oil with minimal differences in mechanical and dynamic properties.

C. BERGMANN, J. TRIMBACH, Z. SALEEM

Replacement of phthalates by vegetable oil derivate plasticiser in NBR compounds

In this study the replacement of DEHP (bis(2-ethylhexyl) phthalate), also known as DOP (diocyl phthalate), DBP (dibutyl phthalate) and DINP (diisononyl phthalate) with a plasticiser derived from sunflower oil, Pionier TP 130 B, in several compounds based on nitrile butadiene rubber (NBR) is discussed. The work describes and compares the vulcanisation behaviour, physical properties before and after ageing, and resistance in different media of the new phthalate-free NBR compounds to the traditional phthalate-based NBR compounds. In addition, it is demonstrated that Pionier TP 130 B provides excellent physical properties and resistance to ageing in various NBR applications.

M. VAN DUIN, P. HOUGH

Zeolite activation of resol curing of EPDM and other rubbers

Sulfur vulcanization and peroxide curing are the main crosslinking technologies for EPDM rubber. Resol curing is the "work horse" for the dynamic vulcanization of EPDM/PP-based thermoplastic vulcanizates (TPVs). It is hardly used for thermoset vulcanization of EPDM, because it is considered to be too slow and suffers from marching cure. Recently, zeolite was identified as a new co-activator for resol curing, enabling high cure speed, high curing efficiency, and a stable cure plateau. Although emphasis of this study is on the activation of various resol curing systems for EPDM rubber, it is also shown that this novel way of activation is applicable for resol curing of other types of rubber, including DIXIR, CR, (H)NBR, BR, SBR, and NR. Depending on the particular resol curing system and the rubber under investigation, the cure rate is strongly increased (reduction of scorch and vulcanization times up to 75 %) and/or the final degree of crosslinking is significantly enhanced (in some cases almost doubled).

M. VAN DUIN, P. HOUGH

Silicone Elastomers and Thermoplastic Elastomers World Summits 2014

Biofene, a renewable monomer for elastomer materials with novel properties.

Polymer development, characterization, and use in elastomer formulations

Amyris is a renewable products company that provides sustainable alternatives to a broad range of petroleum-sourced products. Amyris uses its industrial biotechnology platform to convert plant sugars into a variety of molecules - flexible building blocks that can be used in a wide range of products. Amyris has developed and optimized yeast strains to produce trans-β-farnesene (farnesene or Biofene) and in 2013 began commercial shipments of Biofene, Amyris’s brand of renewable farnesene, from its first purpose-built plant located in Brotas, in southeastern Brazil. Farnesene is a versatile building block and provides differentiated performance across a range of applications. Its conjugated diene structure makes it a direct replacement for butadiene and isoprene, as well as acrylates and other olefins, and it has been shown to be a drop-in monomer into a range of polymerization chemistries, including anionic, radical, coordination, and cationic polymerization. When the diene moiety of farnesene is incorporated into the backbone of a polymer structure, the unique structure of its side-chain enables step-change performance in many materials applications. Amyris has partnered with Kuraray to develop farnesene-based polymers...

J. G. WEIDINGER

Silicone foam: how to expand the fastest crosslinking elastomer

Elastomers in general are less tolerant concerning expansion than thermoplastics, but silicone rubbers are even more challenging: showing very fast curing and being highly permeable for blowing gas they do not seem to offer many chances for being mastered by the manufacturer. Nevertheless, expanded silicones are such interesting due to their unique material properties that it is worth having an eye on silicone foams every time there is news on the raw material and equipment sector. Thus, platinum catalyzed and/or UV curing silicones or novel methods of physical foaming offer new opportunities to reduce densities and to improve silicone foams.
B. GRAU, O. FRANSEN

Self-lubricating LSR – reliable sealing with easy assembly ................................................................. 246

Over the last decades, the number of electrical systems in cars has significantly increased. While electrical side-windows, airbags, and air-conditioning were perceived as luxury in the 1980s, they are now pretty much accepted as standard items in vehicles. In order to meet new and stricter emission standards, additional secondary systems, such as sensors and control units are required to improve engine efficiency. All these secondary devices require electrical connections. These connectors have to be able to operate at a wide temperature range and to resist moisture and various automotive under the hood fluids. The performance of modern can nowadays depends on the seal of the electrical connections. Silicone elastomers can cover a wider range of properties needed for this application compared to other elastomer materials. The silicone materials of choice are self-lubricating to enable ease of assembly of the electrical contacts attached to the cables. For more than 30 years, silicones, especially liquid silicone rubbers (LSRs), have been successfully used in this segment based on their excellent properties and their suitability for mass production. This paper will explain basics of LSR and self-lubricating technology based on an existing broad portfolio of grades. Recent material advancements to meet more demanding applications and specifications are also discussed.

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I. BROOK, G. MECHREZ, R. Y. SUCVEVERIENE, R. TCHOUDAKOV, S. LUPO, M. NARKIS

Facile and novel route for the development of hybrid nanocomposites .................................................. 253

The present work describes a facile and rapid route of conductive nanocomposites production. A novel fabrication method of elastomeric conductive systems containing nanoparticles, carbon nanotubes (CNTs) and polyaniline (PANI). The new synthesis procedure includes an in-situ inverse emulsion polymerization method of aniline doped with dodecylbenzene sulfonic acid (DBSA) in the presence of CNT and dissolved styrene-isoprene-styrene (SIS) block copolymer, followed by a precipitation-filtration step. Incorporation of CNT/PANI in the SIS elastomeric matrix improves the mechanical and the electrical properties of the nanocomposites. Formation of the continuous three-dimensional CNT/PANI network, responsible for enhancement of the resulting nanocomposite properties. The described novel approach provides an opportunity for developing tunable structures of remarkably distinctive architecture.

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A. HULME, S. SPEAKE, J. COOPER

Life prediction of polymers: model validation ....................................................................................... 256

As the service conditions in the oil and gas industry become increasingly more demanding, there is a greater need to demonstrate that the materials selected are fit for service. This is particularly important for polymeric materials as their properties are time and temperature dependent and can be significantly affected by the fluids they come into contact with. To predict life, accelerated laboratory tests can be carried out based on the service conditions the component will experience. In all cases increased temperatures are used to accelerate the tests. A summary of the different approaches which can be used will be presented along with the factors which need to be considered when designing accelerated test programmes. A major concern which is often expressed is the reliability of the life prediction model. It should be recognised that relatively simple material tests cannot possibly replicate the complexity of some product applications. This paper compares the life predictions from accelerated tests with actual long-term test data. The comparison will be made for both the Arrhenius rate approach and time-temperature superposition. Sources will include the Smithers Rapra 40-year natural ageing study and in-house test data.

K. BLANKENSHIP

Fluorinated polyols for ultra-weatherable coatings .................................................................................. 264

Fluoroethylene vinyl ether (FEVE) resins are a unique class of fluorinated resins used in the formulation of various organic coatings. These resins have been studied in 2K coatings for various applications. In an effort to respond to the coatings industry’s need for more environmentally friendly alternatives, two types of waterborne FEVE resins were developed. In this study three coatings based on FEVE resins, two waterborne and one solventborne, were tested for performance properties including accelerated weathering. The results show that a waterborne 2K fluorosilane coating based on a FEVE dispersion exhibits excellent gloss retention after 5,000 h UV-B weathering testing as compared to the more traditional solventborne system.

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