Deciphering the silica/silane reaction mechanism for the development of a new generation of low rolling resistance tires – Part 1 – characterization by in situ IR spectroscopy

By use of suitable organic silanes and controlled mixing conditions, silica/silane systems have proven to be well suited for tire tread formulations with reduced rolling resistance. The bifunctional organosilane is able to react with the silica surface as well as with the polymer. However, silica compounds still present considerable difficulties in processing. The kneader is not only a mixing aggregate but has to fulfill the role of a chemical reactor. It is known from former studies, that the reaction between the silica and the silane is complex. It is up to now not sufficiently understood. Therefore, a better understanding would help many tire producers to control the mixing process more efficiently. Operando IR spectroscopy carried out in-situ during the reaction is the technique of choice to decipher the reaction.

Hybrid cure systems for EPDM and EPM based on organic peroxide and accelerated sulfur

Peroxide crosslinking of ethylene-propylene copolymers (EPM) and ethylene-propylene-diene terpolymers (EPDM) is highly recommended for challenging high temperature applications. The resulting network has a strong crosslink density, consisting of rigid crosslinks, which makes these organic peroxide cured systems thermally stable. Often, such rigid crosslinks show the shortcoming of not being very flexible and not being reversible. This leads to noticeably lower tear strengths and elongation at break when compared to sulfur/accelerator system crosslinked elastomers. This article will show that hybrid cure systems based on combinations of peroxide and sulfur/accelerators can be fine-tuned to allow good processing properties as well as good mechanical properties. Furthermore, even fully saturated elastomers, like EPM, can be crosslinked with such a system, which leads to the formation of polydisulfide crosslinks, resulting in significant positive changes in material properties. Could a hybrid cure recipe lead to materials with properties combining the best case scenario of the two worlds of peroxide and accelerated sulfur cure?

Possibilities of energy-efficient mixing

For years now, energy consumption has been one of the main areas of growing concern for Phoenix production plants due to two main factors: The first factor is the increasing environmental awareness within society itself to conserve resources and to consume for that reason less energy. The other is the huge increase in energy costs that are forcing all businesses to save energy. These conditions are directly and seriously affecting the rubber industry, as it is very energy intensive. The production of compounds, the processing of the mixtures as well as vulcanisation are operations that involve a large amount of energy input. Therefore, comprehensive energy management is a task of very high importance. This article presents the most important measures to reduce helping compound manufacturers their energy consumption and to make use of potential savings.
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Compound development for rubber hoses ................................................................................................................................. 182

The basic principles of compounding and mixing have changed to some extent in the past 20 years, whether the compounds are mixed in China or abroad. However, due to working conditions and a growing number of synthetic polymers, elastomers, and TPEs, coupled with the need for greater productivity and better efficiency, new techniques and methods are continuously being developed and introduced. Indeed, the techniques necessary for the satisfactory mixing and compounding of qualities used in the hose industry are certainly highly variable. In this paper, the compound development and mixing process for the production of rubber hoses will be discussed and the related compound formulations for rubber hoses will be presented.

M. SCHILLER, B. ALDANMAZ, A. ŞAHİN, A. ELİTEZ

Practical aspects of the influence of acrylic impact modifiers and ground calcium carbonate on the impact strength ................................................................................................................................. 188

Impact modifiers and functional fillers are crucial additives for many PVC applications such as window profiles, sidings and some specialized pipe applications. A high dosage is advantageous due to lower costs, however impact strength drops at a certain dosage of filler. Several publications deal with the single effect of either functional filler or acrylic impact modifier. According to the authors' knowledge, only one paper considered the combination of AIM and ultra-fine precipitated calcium carbonate (uPCC) and a synergy between ultra-fine PCC and impact modifier was proposed. The aim of this paper is to investigate if there is an optimum dosage of AIM and ground calcium carbonate (GCC). The influence of particle size and thickness of shell of core-shell modifiers and the influence of interparticle distance of AIM and of GCC particles on impact strength are determined. It was also investigated if there might be a mathematical connection between Gardner and Charpy impact tests.

Trinseo to acquire Italian TPE compounding API ................................................................................................................................. 197

S. SÄNGERLAUB, K. MÜLLER

Determination of the oxygen permeability of films ................................................................................................................................. 198

Oxygen permeability is a selection criterion for packaging materials and it should be measured regularly. Fraunhofer IVV developed for the company PreSens a cost-efficient measuring method and measuring cells, which are now available on the market. Important validation results are presented.

People in the news ..................................................................................................................................................................................... 201

Book reviews ............................................................................................................................................................................................. 202

Suppliers list ............................................................................................................................................................................................. 204

Publication information & contacts ......................................................................................................................................................... 206