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COMPOUNDING AND PROCESSING STUDIES OF RUBBER COMPOUNDS REINFORCED BY SHORT-CUT ARAMID FIBRES WITH DIFFERENT SURFACE TREATMENTS

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In the past a wide variety of short cut fibres has been studied to reinforce elastomers. Natural fibres mainly cellulose, sisal, jute, silk, coir, coconut, bamboo and oil palm fibres have the advantage that they are renewable and sometimes show a better bonding to rubber. Their complicated fabrication and lower reinforcement factors are the disadvantages. Compared to natural fibres, synthetic fibres like nylon, polyester, glass, melamine, carbon and aramid fibres have better tolerances in shape and uniformity due to their continuous fabrication. Nevertheless, brittle fibres like carbon and glass fibres are not so common for reinforcing elastomers, because of the dramatic fibre breakage during processing. Due the lower fibre breakage and the considerable improvement of tribological properties of the resulting rubber composites there is a renewed interest in the application of short-cut aramid fibres in elastomers. In particular, the cut, chip and chunk resistance of truck tires can be enhanced, as reported by Datta* et al. In addition, the hysteretic loss of aramid-fibre reinforced rubber is greatly reduced, which lowers the rolling resistance of the corresponding tires and, therefore, saves fuel and prolongs their durability. Further possible applications of short cut aramid fibre reinforced compounds are dynamically loaded rubber seals, diaphragms, engine mounts, rubber layers on counter-rotating rollers and rotating cylinders, transmission belts, conveyer belts, and hoses. Our studies are related to the investigation of controlled fibre orientation that is induced during processing, including its experimental characterization and the theoretical description of fibre orientation patterns. Further objectives include the investigation of technological and material related parameters on fibre dispersion/distribution after compounding. We show how combined studies using optical microscopy, scanning electron microscopy, confocal scanning laser microscopy, dynamic mechanical analysis and tensile testing are necessary to explore the new generation short-cut aramid fibre reinforced polymer composites.

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* Datta R.N.: Reduced Hysteresis in Truck Tread Compounds by using aramid short fibres, Rubber Chemistry and Technology 79, 2005