Effect of the formulation and the process conditions on the structural network evolution and the fatigue properties of natural rubber

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At the moment, automotive industry focuses on the development of hybrid and fully electric vehicles. These technologies work differently from thermal engines, especially in terms of vibratory regimes. In this context, the rubber parts designed for anti-vibratory systems (AVS) must evolve. Natural rubber (NR) is widely used for AVS due to its unique mechanical properties, especially its significant fatigue resistance. More precisely, the fatigue behavior exhibits a strong reinforcement for non-relaxing loading conditions [1]. Up to now, the reason why such a fatigue reinforcement in natural rubber is generally attributed to the fact that the material is crystallizing under strain, without being able to demonstrate it. In order to better understand and predict the reinforcement of crystallizing rubbers, it is necessary to understand the link between the chemical structure of NR and its fatigue properties. This study deals with the effects of the chemical composition and the process conditions on the fatigue response of NR. A literature review of the effects of ingredients (type and amount) that affect fatigue properties has first been carried out: filler type [2], presence of chemicals and natural rubber grade [3]. It was shown that first order parameters are the curing system (conventional, semi-efficient or efficient) and the process conditions (time, temperature), which drive the chemical structure of the material [4,5,6] and its ability to crystallize under strain [7]. Then, different NR formulations, obtained with a conventional curing system, have been characterized. The effects of chemical structure on the fatigue properties are presented and discussed.

Références

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