

## **Sepiolite with enhanced chemical reactivity as filler for rubber composites**

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### **Introduction**

Reinforcing fillers are essential ingredients of rubber composites and, among them, inorganic oxides/hydroxides play a crucial role. Silica, with adequate coupling agents, is the best filler for tyre compounds with low energy dissipation and fuel consumption [1]. In recent years, interest has been increasing for biosourced fillers. Sepiolite is one of the most studied, thanks to its nanometric size and high aspect ratio [1-2]. However, sepiolite can hardly behave as a reinforcing filler, without establishing a chemical interaction with the rubber matrix. It is possible to pursue such objective by using an efficient coupling agent.

In this study, sepiolite was functionalized with a pyrrole derivative, (2,5-dimethyl-1-(3-(triethoxysilyl) propyl)-1H-pyrrole) (APTESP), by simply mixing in water and heating, performing first evaporation and then the functionalization reaction. The Sepiolite/APTESP adduct was used as reinforcing filler in NR based composites, as the only filler or in a hybrid filler system with carbon black. The composites were prepared via melt blending in internal mixers. Sulfur based crosslinking was carried out and characterization was performed by means of dynamic-mechanical and tensile tests. The mechanical percolation threshold was also investigated.

### **Results**

The adduct Sepiolite/APTESP was successfully prepared, by using water as the reaction medium. The amount of APTESP was between 5 and 10% and the functionalization yield was higher than 70%.

Sepiolite promoted the dynamic-mechanical reinforcement of the rubber composites, thanks to APTESP as coupling agent. The mechanical percolation threshold in sepiolite, as the only filler in NR, was observed at a sepiolite content of about 15 phr. When sepiolite/APTESP were used in place of CB, similar or lower values of hysteresis were obtained.

### **References**

[1] Applied Sciences, **2022**, 12(5), 2714.

[2] KGK, **2020**; 73, 26-35