

Mechanisms of dispersion in silica filled elastomers: Input of different approaches

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Precipitated silica is traditionally used as reinforcing filler in rubber applications. In pneumatic manufacture, it offers several advantages compared to carbon black. Indeed, in tyre treads, precipitated silica can yield a lower rolling resistance and better wet grip at equal wear resistance than carbon black.

Filler dispersion can be characterized using different methods (. In the present work we use three different approaches to compare the dispersability of two grades of amorphous precipitated silica in the shape of micropearls, characterized by different specific areas. The three approaches are:

- the first approach is based on the analysis of the behaviour of silica micropearls under mechanical stress in air (fluidized bed and impact on wall) and in water (ultrasounds), dispersion kinetics of silica measured into air or water with the development of specific descriptors to follow dispersion kinetics,
- the second method is based on the characterization of dispersion mechanisms of silica micropearls into the elastomer matrix in the diluted regime via the use of a transparent counter-rotating plate-and-plate shear cell coupled with an optical microscope. In this case, the micropearl is subjected to hydrodynamic stresses due to the shear of the elastomer matrix,
- the last method is based on the analysis of dispersion during the mixing operation of silica and the elastomer in an internal mixer coupling information from rheology, bound rubber and SEM to follow the dispersion.

We will show that the different approaches bring complementary information on the dispersion mechanisms but also on the intrinsic properties of silica.

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