# Dispersion of agglomerated fillers in a polymer matrix :

# Input of a rheo-optical approach and rheology

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**Abstract** :

The mixing of the filler and the polymer matrix implies different processes e.g., (i) incorporation, (ii) distribution and (iii) dispersion of the filler. The dispersion process corresponds to the reduction of the size of the filler introduced as agglomerated pellets (a few hundred microns) down to the size required for the aimed properties during the mixing operation. For mechanical properties, the objective is to decrease the size to the smallest achievable size (nanometric size for nanofillers). Dispersion and distribution processes will define the dispersion state of the filler in the final product and thus its end-use properties.

The control of the final structure after compounding implied to understand the mechanisms responsible for the filler size reduction. A transparent counter-rotating shear cell coupled with an optical microscope was used to study in-situ during the action of shear the mechanisms of dispersion of agglomerated fillers in a polymer matrix. Dispersion mechanisms of carbon black pellets and amorphous precipitated silica micropearls will be presented. Mechanisms and their key parameters, the relationship with the intrinsic parameters of the filler will be discussed in a first part [1-4].

Once the filler is dispersed, it is of prime importance to characterize the filler dispersion state inside the polymer matrix. In the case of nanofillers, the structure of the nanocomposite must be characterized at different scales ranging from the micrometric (SEM) to the nanometric scale (TEM, X-rays). Shear rheology (in the molten state) allows to access information on the structural features of the nanofiller inside the polymer matrix [5]. The rheological behaviour of nanocomposites based on organoclay dispersed in a compatibilized polypropylene matrix will be described and discussed in terms of network structure formed by clay particles within the matrix and its dynamics [6-7]. The rheological response of the network depends on the dispersion state of the filler [8-9]. The rheological signature of the network can be used to follow the filler dispersion state during a compounding operation [10-11].

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