

## The mechanisms of carbon black dispersion during elastomer processing.

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### ABSTRACT:

Processing carbon black filled elastomers means to have been able to disperse and distribute the carbon black pellets into the not-yet reacted elastomer. The quality of the final product is strongly dependent on the quality of the dispersion and distribution. We will examine here the dispersion, which depends first on the infiltration of the elastomer into the carbon black pellets.

Infiltration. As fillers are porous materials, polymer can infiltrate into their pores which modifies their cohesion strength and affects the dispersion mechanisms. If infiltration by a Newtonian matrix is well characterized, infiltration of elastomers into silica pellets was only recently shown to happen. The knowledge of the effect of external parameters (such as pressure, shear and temperature) present during a mixing operation on infiltration kinetics is fundamental since it will define the relevance of the infiltration depth on the mechanisms of dispersion during mixing. Whereas the accelerating effect of temperature and pressure on infiltration is similar in Newtonian and elastomeric matrices, shear has no effect on the infiltration speed in a Newtonian matrix but accelerates the infiltration process in a highly visco-elastic fluid. These results will be discussed.

Dispersion. To identify, understand and model the flow-induced dispersion processes of carbon black in highly visco-elastic (rubber) matrices are achieved by using a transparent counter-rotating rheometer which enables to perform in-situ optical observations of the dispersion mechanisms under shear. The behaviour of carbon black in three different matrices (EPDM, BR and SBR) has been investigated and compared. Two main mechanisms of dispersion were identified in Newtonian and elastomeric matrices denoted as rupture and erosion. We will show that erosion in rubbers is complex and proceeds via different mechanisms which are controlled by the infiltration depth of the matrix into the pellet and the elastic nature of the matrix. The behaviour of carbon black in three different matrices (EPDM, BR and SBR) will be compared and discussed in terms of these parameters. The effect of the concentration of filler on dispersion mechanisms has also been studied.

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