

Micro- vs. macro- dispersion: Payne effect as indirect micro-dispersion measurement for silica-reinforced elastomer compounds

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ABSTRACT

The process of mixing silica into an elastomer determines the interaction between the different components and significantly influences rheological properties, shaping processes and final mechanical properties. Mechanical breakdown of silica clusters as well as a chemical reaction between silica and silane coupling agent have to occur simultaneously during mixing. The breakdown of silica clusters generates a distribution of filler particle sizes ranging from light microscopically visible macro- to sub-micron dispersion. It is the latter which has the most significant influence on the mechanical properties because the sub-micron clusters are the real reinforcing species. It is a challenge to maintain a consistent level of micro-dispersion between every mixed batch.

Can the Payne effect be employed as an indirect but reliable indicator for micro-dispersion and inter-particle interaction? The paper will review recent advances in our research on answering this fundamental question.