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INFLUENCE OF PROCESSING CONDITIONS AND INDUCED SHEAR WORK ON THE THERMAL, RHEOLOGICAL AND MECHANICAL BEHAVIOR OF POLYMER NANOCOMPOSITES

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In the last years, the polymer industry has taken an exceeding interest in the use of polymer nanocomposites (PNC). PNC are filled polymers, where the nanofiller has at least one dimension in the order of nanometers. The main advantage of these nanofillers in the polymer matrix, compared to conventional micro-scaled fillers, is the significant smaller amount of filler (< 5 wt%) needed to improve properties such as Young's modulus or barrier and flammability properties. Layered silicates are the most commonly used nanofillers due to the possibility to achieve aspect ratio ideally up to 1000. Thereby organo-modified montmorillonite (MMT) is the most common representative.

In this work, polypropylene (PP) based nanocomposites filled with the layered silicate Nanofil SE3010, provided by Rockwood Additives Ltd., are kneaded with a Haake laboratory kneader to investigate the influence of different processing conditions such as rotation speed (60, 90, 120 rpm) and residence time (5, 15, 25 min) on the thermal, rheological and mechanical behavior. The compatibilizer (polypropylene grafted maleic acid anhydride) admixture content relative to the organoclay content (1 and 5 wt%) was chosen at a ratio of 1:1 (clay:compatibilizer).

The standardized shear energy was calculated using torsional moment and power. Afterwards the produced PNC were analyzed and characterized regarding thermal (differential scanning calorimetry), rheological (rotational rheometer) and mechanical (tensile tests) aspects.

It is a target to determine, whether a short and intensive or a long and soft process performs better. Especially the residence time has a major influence on the behavior of PNC as the exfoliation is a diffusion process.