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Plasticising and mixing zone of a co-rotating twin-screw extruder

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Contemporary plastics processing industry calls for the development of novel manufacturing methods for materials of prime and consistent properties. This demand gives rise to new constructional solutions for plasticizing systems which would maximize efficiency and retain optimal properties of the material processed. Polymer composites and compositions are typically manufactured by means of twin-screw extruders equipped with screw segments. This proves to be beneficial as it is possible to adapt the geometrical properties of the segments to the material processed. This study was aimed to analyse the impact of the configuration of the plasticizing and mixing zone of a EHP-2x20 co-rotatingtwin-screw extruder on the properties of the talc-filled polipropylene extrusion. The analysed zone comprised 8 triple-lobe kneading discs, i.e. 10 mm long cam discs. The variableswere the inclination angle of the pseudohelix formed by the apices of neighbouring kneading elements (0°, 30°, 60°) as well as the distance between these elements (0.5 mm, 2.5 mm, 4.5 mm). In the research plan, 5 different zone configurations were considered, located invariably at the same distance from the feed end. Additional variables included the degree of filling with talc(10%, 13%, 16%) and the rotational speed of the screws (100 rpm, 250 rpm, 400 rpm).On the basis of the measurements taken, it was possible to determine the value of the following factors analysed: mass-flow rate of extrusion, head pressure, screw drive torque, extruder energy consumption per unit, ultimate tensile strength, and the melt mass-flow rate.

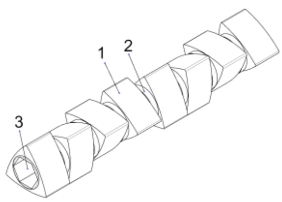

Figure 1. Example of plasticizing and mixing zone:

1- triple-lobe kneading element,
2- spacer,
3- hexagon drill for the screw core

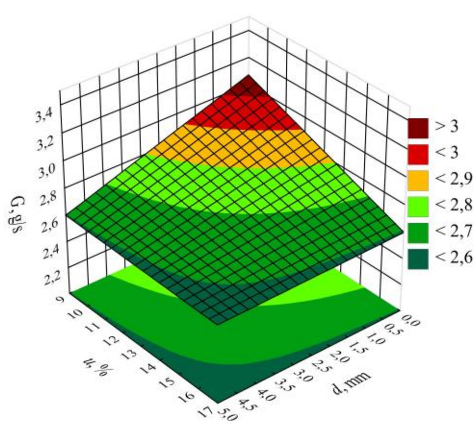

Figure 2. Response surface plots of mass flow rate of extrusion as a function of spacer width and talc content

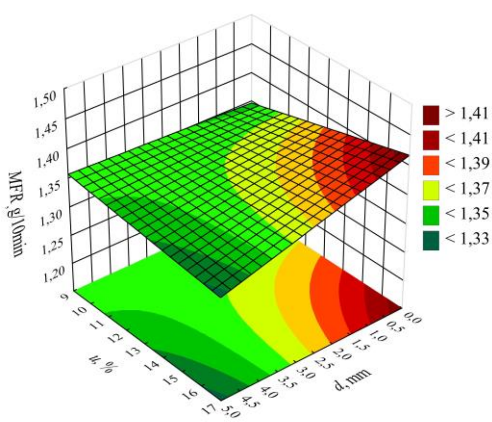

Figure 3. Response surface plots of melt mass-flow rate (MFR) as a function of spacer width and talc content