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ON-LINE RHEOMETRY TO MONITOR NANOCOMPOSITES PRODUCTION AT THE INDUSTRIAL SCALE

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Melt compounding is the most capable alternative to produce polymeric nanocomposites in an industrial scale. However, to produce nanocomposites with enhanced properties using this technique it is necessary to have a good knowledge on the effect of both material properties and processing conditions on nanoclay dispersion. In last decade, this research team has been involved on the development of on-line rheometers able to monitor the evolution of nanoparticles dispersion during compounding, at a lab scale. These devices have been extensively used as means of measuring the rheological properties of polymers and polymeric nanocomposites, during the extrusion/compounding process. The scope of this work is to demonstrate the developments performed for these devices: the design and manufacture of a flow cell that can be coupled to any extruder at the industrial scale, allowing the extension of the monitoring capabilities to industrial scale. The on-line oscillatory measurements were made at the end of an industrial extruder under different processing conditions (screw speed and throughput), for different the clay types and compositions. The extrudate produced was pelletized for off-line rheological and structural characterization, using oscillatory rheometry, XRD, SEM; TEM and mechanical properties. Based on the good agreement obtained between on-line and off-line results, it was possible to conclude that the on-line rheological characterization methodology developed was able to monitor nanoclay dispersion at the industrial scale.