OP-4-359

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CALCULATION OF THE TEMPERATURE AT THE BARREL'S INNER SURFACE OF CO-ROTATING TWIN-SCREW EXTRUDERS

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In most cases, the barrel temperatures set at the extruders are used as one of the input parameters for calculating the melt's temperature development in co-rotating twin-screw extruders (used to simulate the process behaviour). Although this is used in practice, the interface temperature between melt and barrel material is actually needed. The interface temperature, however, can not currently be calculated exactly for dissipative flows.
The barrel temperatures set at the extruder can clearly differ from the actual temperatures at the interface between the melt and the barrel. One possible method for determining the temperature directly at the barrel's inner surface is to calculate it starting from the cooling channel. However, the geometrical arrangement of the cooling channels differs for every series and each machine manufacturer. We initially consider two standard arrangements of cooling channels. One arrangement is for the cooling channels to run parallel to the barrel's bore and the others are winding around the barrel's bore. It is important to know the heat flux per surface area which can be maximally dissipated from the melt by cooling the barrel. Based on each of the channel geometries, these can be used in the melt temperature's calculation to determine more precisely the heat flux in the direction of the channel height. Process spray cooling, which is currently the usual procedure, has to be considered in this calculation. During spray cooling, the water is injected into the cooling channel as droplets which are produced as small as possible. In this way, the maximum surface for effective cooling of the barrel is made available.
A model for determining the interface temperature, which was implemented in the simulation program SIGMA, will be introduced. A comparison of the simulation results and the experimental tests corresponds well to those of flow-cooled barrel elements.