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Numerical study of the spatial flow of abnormally viscous fluid in the extrusion mixer screw channel.

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Among the various methods of polymer processing extrusion method is the most productive, which allows continuously produce long articles - cable, films, tubes, etc. During the processing of polymers by means of screw extrusion machines, a number of problems associated with the feature of flow and heat transfer in a the extruder channel are arises[1]. From a practical point of view, one of the main problems is the thermoregulation process in order to obtain a homogeneous, thermally homogeneous polymer at the outlet of the extruder, the minimization of local overheating of high viscosity material. Particular importance the task is acquiring in the case of screw wear during operation, when an increase in the radial clearance over the screw crest results in high flux leakage and, consequently, reduces the throughput of the extruder, the temperature field redistribution, in some cases to increase the maximum and the medium flow temperature, increase residence time of the polymer in the extruder channel.

Currently there are a number of mathematical models describing the flow and heat transfer in helical channels of extruders [2,3]. All well-known approaches, based on the conservation laws, using the principle of facing traffic and deploying helical channel on the plane.

In this work was considered a three-dimensional heat and mass transfer process of a nonlinear viscous fluid in a plane and directly into helical and metering channel of extruder. As a result of studies were obtained fields of velocity, temperature and pressure in the channel cross section and channel length. In the context of the three-dimensional formulation of the problem the influence of the radial gap on flow and heat transfer in the extruder screw channel is analyzed. The comparison of the results obtained for the deployed, planar, channel with the results obtained for the helical screw channel.

REFERENCES

[1] Trufanova N.M, Shcherbinin A.G., Yankov V.I. Melting polymers in extruders./M.-Izhevsk: SIC " Regular and Chaotic Dynamics ", Institute of Computer Science, 2009.-336 p. ISBN 978-5-93972-420-5

[2] Syrjala S. Numerical simulation of nonisothermal flow of polymer melt in a single-screw extruder: a validation study // Numerical Heat Transfer, Part A. 2000. V. 37. P. 897–915.

[3] Rauwendaal C. Finite element studies of flow and temperature evolution in single screw extruders // Plastics, Rubbers and Composites. 2004. V. 33. № 9/10. P. 390–396.