



ROTATION EXTRUSION OF HDPE PIPES WITH HIGHER PERFORMANCES

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HDPE pipes have been widely used as gas or water transport pipes. How to enhance their strength and crack resistance remains a big challenge. This paper reported a novel rotation extrusion technique to prepare HDPE pipes with higher performances. This technique has the following features: both the mandrel and the die can rotate, either independently or integratedly; the inner and outer walls can be simultaneously cooled down, and the cone-shaped sizing unit can enlarge the pipe to make further hoop orientation of PE molecules. Therefore, the stress and temperature field can be easily controlled during the rotation extrusion so as to adjust the crystallization and orientation of PE. The theoretical analysis on four different rotation modes revealed that the HDPE melt flow during the rotation extrusion deviated from the axial direction and formed a complicated helical flow, depending on the rotation mode, the rotation speed and the radial position. The experimental results confirmed that the HDPE shish-kebab crystal formed upon rotation deviated from the extrusion direction, which could be further fixed by double cooling on both inner and outer walls of the pipe. As a result, the performances of the PE pipe were significantly improved, e.g., the hoop tensile strength and the crack initiation time of the HDPE pipes manufactured by the novel rotation extrusion technique could increase by 78% and 544% respectively, as compared to those of the conventionally extruded pipes.