Physico-chemical nanomaterials science

Nanostructurization and structural relaxation of the polyethylenes' welded joints formed under the impact of the constant magnetic field

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Previously we have presented the results of complex studies of polyethylene (PE) welds, mainly high-density polyethylene (HDPE) welds, their structure, thermophysical, operational characteristics, analysis of these results and basing on that some hypotheses of welded joint and weld structure formation. Using wide- and small-angle X-rays scattering methods, differential scanning calorimetry and methods of thermo-mechanical analysis some structural and thermal properties of PE-80 and PE-100 polyethylene samples and of PE-80/PE-100 hot tool butt welds have been investigated. We have defined that the welded joint of two dissimilar types of polyethylene had better-ordered crystalline structure in textured amorphous microstructure with bigger areas of heterogeneity comparing to the individual polyethylene samples. Also, it was shown that the strength and thermal stability of the welded joint material were higher comparing to those properties of the initial materials.

In the present work the structural features, thermal and performance properties of PE-80/PE-80 and PE-100/PE-100 welded joints obtained with and without impact of constant magnetic field (B ~ 1 T) have been investigated, as well as of pure polyethylene PE-80 and PE-100. It is shown that the impact of transversal constant magnetic field on the melts of the same-type polyethylene specimens during their welding causes formation of aligned structure, where the axis has the same direction with the sense of magnetic field. This also causes improvement of the weld's thermal properties. When the weld is formed under the impact of the longitudinal constant magnetic field this field counteracts with the force field applied during the welding, and this causes worse performance properties of the welds. Also, the annual structural relaxation of the polymer in the abovementioned welded joints is investigated. The results of these investigations show that the crystalline phase as well as amorphous phase of polymeric material in the welded joint undergoes structural relaxation.