Physico-chemical nanomaterials science

Structural features of welded joints of the heat-resistant plastics

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Nowadays the requirements for durability, strength, heat-resistance of industrial plastic products for oil and gas, aerospace and other industries are constantly increasing. In recent years, new high-performance polymeric materials, such as polyetherimides (PEI) and polyetheretherketones (PEEK), have already become competitors to metals, ensuring long-term reliability, heat, thermal, chemical and radiation resistance in difficult operating conditions of specific constructions. These polymers are used in a pure form as well as a matrix for various composite materials. At the same time manufacture of many products needs joining of polymeric parts, so the development of efficient technologies of such heat-resistant polymers welding is actual.

In the present work welding of polyetherimides and polyetheretherketones was performed in three ways: heated tool, ultrasonic and thermistor welding.

It was revealed that materials melts are prone to cavitation that degrades the quality of welds. For the best understanding of the welding processes [1] and development of the efficient welding technology the structural features of the welded joints were studied by optical (TOM and POM) and electron microscopy (TEM and SEM), wide-angle (WAXS) and small-angle (SAXS) X-ray spectroscopy. As the result it was found that the strongest joints were formed by welding at "soft" modes. The mechanical strength of joints at break has been received about 86% comparing to the mechanical strength of the basic material at optimal mode of butt welding and 100% at optimal mode of overlapping welding, which are the maximum level reached in the world (according to the literature) by similar types of welding for these materials.

1. *Galchun A., Korab N., Kondratenko V., Demchenko V., Shadrin A., Anistratenko V., Iurzhenko M.* Nanostructurization and thermal properties of polyethylenes' welds // Nanoscale Research Letters.-2015.-**10**.-P. 138-149.