

Analysis of dimensional stability of recycled plastic material obtained by grinding

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Abstract: A study to identify the products of grinding process for the purposes of the recycling of elements, installations and materials made from polymers was proposed. The ground material was analyzed, evaluated and then described using the latest granulometric models. Based on the stability models, a mathematical description of granulometric distribution of particle size of the recycled polymer products obtained in the grinding process was found.

Keywords: grinding process, recycling of polymer materials.

Analiza stabilności wymiarowej produktu rozdrabniania w recyklingu tworzyw

Streszczenie: Dla potrzeb recykulacji elementów, instalacji i materiałów z tworzyw polimerowych zaproponowano badania identyfikujące produkty rozdrabniania. Analizowano, oceniano, a następnie opisano je na bazie najnowszych modeli granulometrycznych. Modele stabilności pozwoliły na znalezienie matematycznych opisów rozkładów granulometrycznych uzyskanych produktów rozdrabniania w procesie recyklingu tworzyw polimerowych.

Słowa kluczowe: proces rozdrabniania, recykling tworzyw polimerowych.

In most approaches, the dimensionally stable precision grinding design should include the following aspects:

- kind of polymer material and its properties,
- technical preparation of granulated product from various elements,
- conditions of forming of granulated product,
- the parameters of processes that are combined,
- variation of tools, installation, use of instrumentation,
- requirements of mixing, shearing and other processes.

Accuracy of grinding represents a separate issue. When studying multi-disc grinding machines, and others that contain several rings (Table 1, item 1), to achieve the precision grinding of PVC [poly(vinyl chloride)] pieces, the most important were accuracy of setting the speed of the rotor and maintaining constant velocity in the range of 10–100 m/s (Table 1, item 1, col. 3).

Similar requirements ensuring the precision operating process were found in the case of multi-disc grinding of PE (polyethylene) materials (Table 1, item 2).

The precision grinding by quasi-shearing equaled $P_{84} = 1$ in this case, for 100 % load of each piece.

The aim of this work was to analyze and evaluate the stability of particle sizes and geometric forms of the grinding products in recycling of polymers.

For achievement of the objective, it was decided to solve the problem given in the form of questions: which technical conditions (construction, tools and machines, parameters of process) are essential for the existence of the highest geometric quality of the grinding product in the recycling of selected polymers, while maintaining reasonable parameters of efficiency and safety of the process [1–4].

GRANULOMETRIC MODELS OF GRANULATED POLYMER PRODUCTS

Polymers are a group of materials for which, in recent years, an expansion in volume of about 9 % by weight per year has been observed. They represent one of the most dynamically developing industries. According to UNIDO (The United Nations Industrial Development Organization), production and processing of macromolecular materials have been recognized as the most expansively growing field of materials in the world.

In polymer processing technology, the materials, methods, equipment and organizational aspects are very closely related, and one of the important issues linking this fields is the transfer of knowledge [5–7]. The question of dimensional stability of polymer material subjected to

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