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Study on surface smoothness of extruded polyolefin compound contained high content of filler

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Abstract: Selecting different fillers of ATH and under different conditions of extrusion, effects of particle size and its distribution of the fillers on the surface smoothness, the mechanical properties and the section morphologies of specimens are studied in this paper. Some factors, which influence the technology, are found and the extrusion quality is increased.

Keywords: polyolefin smoothness of surface

1. Introduction

Modification of filler is one of the methods of improving polymer properties. But friction resistance increases with the increasing of filler content. When the extruding speed goes beyond some limit, the unstable flow will emerge and the surface will not be smooth any more leading to decrease the quality and output [1]. So in the last fifty years, a lot of observation and research about this phenomenon were made. In this article, the high filled polyolefin is studied with respect to the extruding speed, particle diameter of filler. Our goal is to study the factors which influence the smoothness of extruded surface, and to seek some ways to avoid or decrease the chance of fracture. Experiments show that decreasing the extruding speed will be helpful to make extruding steadily and using smaller ATH can greatly improve extruding properties。

2. Experiments

2.1 Materials and equipments:

Aluminum hydroxide (abbreviation: ATH) of filler grade from Shan dong aluminum company; APYRAL 60E ATH from Germany; EVA from Beijing organic chemical plant; Carbon blacks bought from the market.
TE-34 type two-stage screw extruder from Nan Jing Keya company; GRH-10 type high speed heating mixer from Liao Ning; Brabender torque rheometer, made in Germany; S-2700 type scanning electronic microscope (SEM), made in Japan.

2.2 Preparation of Samples:

According to the prescription, all kinds of fillers, processing auxiliary and so like were accurately weighed. Various materials were put in high-speed mixer and stirred for 6 minutes. Then mixed materials were put in TE-34 type two-stage screw extruder for plastication and making a grain, The rheometer extruded the grains into samples of tape and tube. The surface smoothness of tape and tube were observed.

2.3 Measurement

The rheologic property was measured by Brabender torque rheometer. Elongation at break was measured by INSTRON-TSK at a tensile speed of 250 mm/min. The sections of samples after being vacuum sprayed by Au were observed and taken for photos by SEM.

3. Results and Discussion

3.1 The effects of extruding speed on the smoothness of surface.

Deformation of the extruded surface is often called "sharkskin" i.e. a coarse extruded surface with small quasi-periodic ripple. The amplitude of deformation is about 1% of extruded diameter [3]. Different extruding speed may generate different shapes of polymer.

The same black grains are extruded into tape sample and tube sample by Brabender torque rheometer under the same experimental condition, respectively. The relation between extruding speed and smoothness of surface is shown in Table 1.