Overview

Nofia HM1100 can be added directly to the hopper of an extruder together with the base resin that requires flame retardancy (FR). However, feeding a master batch of Nofia HM1100 in polyethylene terephthalate (PET) or polybutadiene terephthalate (PBT) for PET applications can be advantageous:

- Increase drying temperature of Nofia based material in line with drying temperature of PET (~150°C).
- Improve homogeneity of the blends, especially when using single screw extruder.

Which carrier, PET or PBT, is most suited for a particular application depends on a number of factors:

- PET master batch needs recrystallization, PBT master batch not.
- PET is thermally more stable at higher temperatures than PBT.
- Where transparency is desired, PET needs to be used.

The loading level of Nofia HM1100 needs to be optimized depending on the requirements of the sintering temperature (the temperature at which pellets start to stick together; lower loading (e.g. ≤ 50 wt%) will give higher sintering temperatures (> 150°C)) and the possible let down rates at customers. The graph below gives an indication of the possible sintering temperatures of Nofia HM1100 PET and PBT master batches provided all guidelines in the sections below are all properly followed.
Recommendations Nofia HM1100 in a PET Master Batch

Master batches with Nofia HM1100 need to be dried before they are used in extrusion operations. They can stick together in the dryer if dried at a too high temperature, or in the feeding zone of an extruder when being used (“sintering”). Caution should be taken in compounding, recrystallizing and drying of PET master batches as recommended below.

Compounding

To achieve high sintering temperature (>150°C), the following recommendations should be followed for making PET master batch:

- Nofia HM1100 loading should be < 50 wt%
- PET needs to be dried < 50 ppm
- Nofia HM1100 needs to be dried < 200 ppm
- The compounding temperature should be low, e.g. 260–270°C.
- When die swell is observed during compounding, the water bath level should be as close to the extruded strand at the die (e.g. 8 cm) as possible so stranding with cutter can be accomplished.

Sintering temperature as a function of the Nofia HM1100 loading for a PET and a PBT master batch of Nofia HMN1100. The compounding temperature profile for each master batch (inlet – die) is given in brackets.
Recrystallizing

- Dry the amorphous master batch at 80°C until the moisture < 500ppm
- Increase temperature to the peak recrystallization temperature (measured by DSC)

Drying of the master batch

If the recrystallized master batch has moisture < 500 ppm, set drying temperature to desired temperature (< sintering temperature).

If the recrystallized master batch has high moisture > 500ppm, dry the crystallized master batch at 80°C until moisture < 500 ppm, then increase the drying temperature to desired temperature (< sintering temperature).

Recommendations Nofia HM1100 in a PBT Master Batch

The sintering temperature of a PBT master batch is a function of the Nofia HM1100 loading, the moisture content of the starting materials, and the compounding temperature settings.

Compounding

To achieve high sintering temperature (≥ 150°C), the following recommendations should be followed:

- Nofia HM1100 loading should be ≤ 50 wt%.
- PBT must be dried < 200 ppm (PBT hydrolytically unstable).
- Nofia HM1100 needs to be dried < 200 ppm.
- The melt temperature during compounding should be low. Reverse temperature profile be used, e.g. 240 – 230°C from inlet to die.
- When die swell is observed during compounding, the water bath level should be as close to the extruded strand at the die (e.g. 8 cm) as possible so stranding with cutter can be accomplished.
Drying Guidelines for Nofia Phosphonates

Nofia phosphonates are hygroscopic materials and quickly absorb moisture from the atmosphere. The presence of moisture will hydrolyze the polymer in the melt phase, reducing the molecular weight. Therefore, it is critical that the material is thoroughly dried prior to melt processing (<50 – 200 ppm moisture). For recommendations on drying, please refer to FRX Polymers’ Technical Bulletin “Nofia Phosphonates Drying Recommendations”. 

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