Dpt Industrial Engineering

Polymeric Materials Engineering
A.Y. 2018-2019
Prof. Luca Fambri

Group 3 // LAB SESSION N.4

Polymer Processing

Compression Molding and compounding / Injection molding and shrinkage / Filament Analysis

(Date) May 16th 2019
/ Friday May 17th

List of components

Laboratory of Processing (Ground -2)
Department of Industrial Engineering - Povo

Assistant : Francesco Valentini
or Denis Lorenzi
or prof Luca Fambri

Processing of Plastics
Compression Molding and compounding / Injection molding and shrinkage / Filament Analysis

1) Compression Molding

Carver Press
Stainless Steel plates and Mylar (PET) foils / Frame dimension
Temperature / Pressure / ~~Time of Cycle~~. Water cooling
PP amount and manual pellets distribution

Plate 1: production from pellets (initial weight and final plate size)
➔preparation of dumbbell specimens

1B) Compounding (Internal Mixer)

Thermo Haake Rheomix 600: temperature, time, rotation blade, PP amount
Final amount of compunded PP

Plate 2: production from compounded PP (initial weight and final plate size)
Same info Plate 1 ➔preparation of dumbbell specimens

Polymer description (Melt Flow data : from Lab Session 3 or Literature

2) Injection Molding Sample evaluation

ISO dumbbell specimens : section size 10.0 x 4.0 mm -

Measure the mold cavity : internal mold dimensions length-width-thickness
POM (bi-injected) : length-width-thickness
PA11 (mono-injected) : length-width-thickness
PP-GF30 (white) and PP-GF35 black
PA6-GF50 (and comment?)

⇨ Shrinkage evaluation : longitudinal / transversal - thickness

ASTM dumbbell specimens : section size 12.7 x 3.2 x **165** mm
Various materials : 3 type of recycled ABS (color and year); COC; ~~various PP~~ (commercial name-year); HDPE (Eltex yellow); PE/PP blend; PA11; TPU
Dimensions of dumbbell Weight of the sample (Dumbell+Sprue+Bar)
TABLE (Material / W / length ; width; thickness etc/…..

⇨ Shrinkage evaluation : longitudinal and transversal
⇨ Comparison of total weight and polymer density (assume a blend PE/PP 50%; COC from literature)

predizioni ↓ cN/dtex estrapolati

• σy di bulk senza DR
• scala lineare σ

step: DR effetto? a freddo partendo da MFI diametro ~1 mm

DR come fattore moltip. sforzo

3) Filament analysis

Evaluate diameter as function of process conditions. Add titer (tex)
Plot average fiber diameter versus collection rate → basso

TABLE Calculate the Orientation factor (apparent Draw Ratio in spinning);
= (diameter die / fiber diameter)^2
Resulting fiber titer : tex and denier
Assuming: PP density of 0.905 g/cc ; stress at yield 25-30 MPa
Stress at break and deformation at break

Calculate load at break and tenacity

FINAL NOTES *Various PP samples have been produced for mechanical characterization in the Lab Session of the Course " Materials Characterization " (prof A Pegoretti)*

Summarize the results of processing

Table
Comparison of different processing technique for production of various samples

i) Compression molding 1 (dumbbell from pellets)
ii) Compounding in Rheomixer (tangential rate)
iii) Compression molding 2 (dumbbell from compounded pellets after rheomixing)
iv) As-spun fibers: rate of collection/rate of extrusion

References

Technical data sheet of PP HiRONlen V15 Nero
Technical data sheet of PP