Abstract

1 Experimental activity

1.1 Injection molding: sample evaluation

Different speciments of unknown polymeric materials have been analysed and identified. They have been produced by injection molding according to specific standards (ISO and ASTM).

- ISO 10.0 x 4.0 x 172 (mm);
- ASTM 12.7 x 3.2 x 165 (mm);

Size of all speciments and the mold cavity have been measured through a caliper in order to evalaute the shrinkage after the process. ASTM samples (with sprue and bar) have been weighted through the balance METTLER PM 4600 in order to compare the total weight and polymer density.

2 Results and discussion

2.1 Injection molding: sample evaluation

ISO speciments are reported in Figure 1.

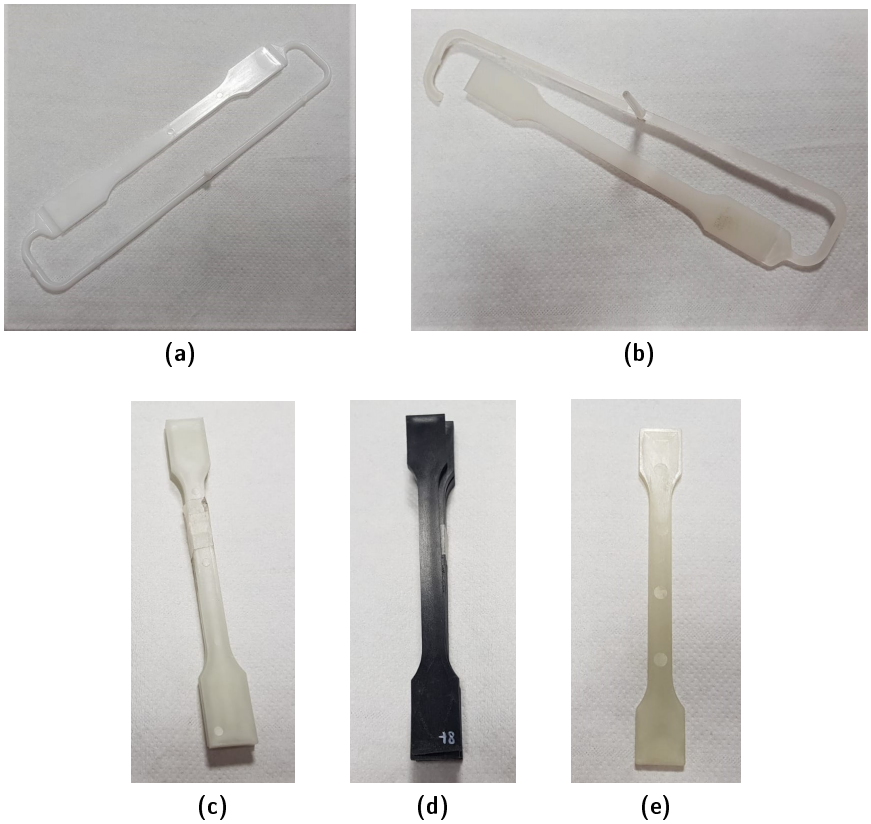

Figure 1: ISO samples: a) POM; b) PA11; c) PP-GF30; d) PP-GF35; e) PA6-GF50.

In Table 1 different types of ISO speciments are classified with their sizes.

Table 1: ISO speciments and characteristics.

Figure	Material	Size(mm)	Description
a	POM	9.74x3.94x167.06	white and presence of cold junction
b	PA11	9.86x4.05x168.98	opaque and white
c	PP-GF30	9.88x4.00x172.11	white and stiff
d	PP-GF35	9.80x4.00x171.86	black and stiff
e	PA6-GF50	9.99x3.98x154.71	very stiff

In Table 2 the values of the shrinkage of ISO samples are reported.

Table 2: Shrinkage of ISO samples.

Samples	Longitudinal shrinkage	Transversal shrinkage	Thickness
POM	0.0280	0.0260	0.0150
PA11	0.0170	0.0140	−0.0120
PP-GF30	0	0.0120	0
PP-GF35	0.0008	0.0200	0

From Table 2 it can be noticed that in reinforced polymers the shrinkage is very small, almost negligible. The presence of glass fibers gives to polymers better dimensional stability during cooling.
ASTM speciments are reported in Figure 2.
In Table 3 different types of ASTM speciments are classified with their sizes.

Table 3: ASTM speciments and characteristics.

Figure	Material	Weight(g)	Size(mm)	Description
a	ABS	14.78	12.77x3.27x163.55	grey and flexible
b	COC	14.07	12.64x3.30x164.04	transparent and glassy
c	PP	12.28	12.6x3.35x162.29	opaque and flexible
d	HDPE	12.73	12.54x3.33x160.0	yellow and very flexible
e	PE/PP blend	13.30	12.66x3.31x161.58	matt black and flexible
f	PA11	14.00	12.6x3.35x162.29	very similar to PP
g	TPU	17.16		glossy black and most flexible

In Table 4 the values of the shrinkage of ASTM samples are reported.
From Table 4 it can be observed that semycristalline polymers (such as PP, HDPE, PA11) have higher values of shrinkage respect to amourphous polymers (such ABS and COC).
In Table 5 weights and densities of ASTM samples are reported. Densities have been taken from .....
For PE/PP blend it has been considered a blend constituted by PE/PP 50%. From Table 5 it can be noticed that, for the same volume, weights of samples are in accordance with values of densities taken from literature.

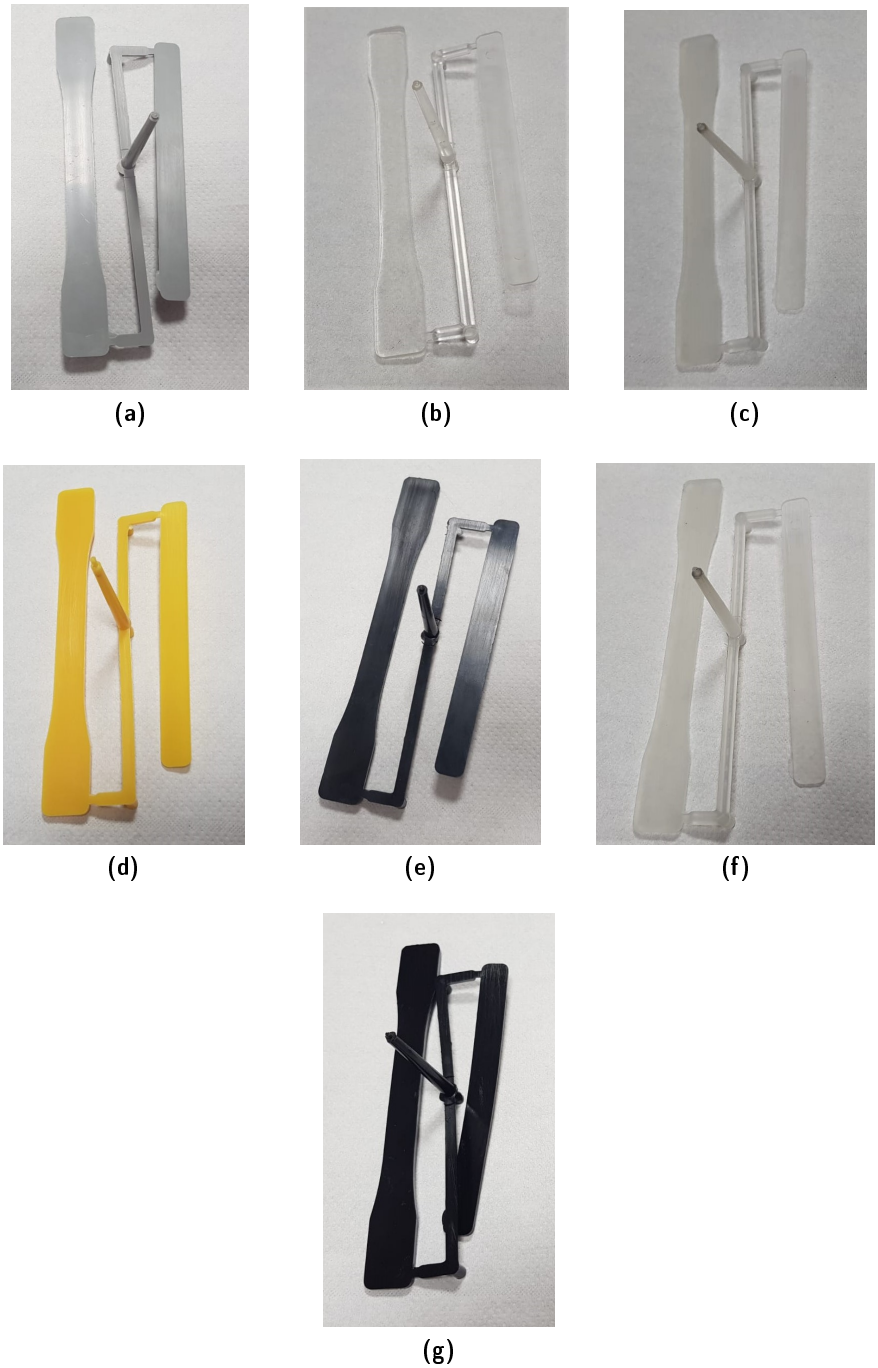

Figure 2: ASTM samples: a) ABS; b) COC; c) PP; d) HDPE; e) PE/PP blend; f) PA11; g) TPU.

Table 4: Shrinkage of ASTM samples.

Samples	Longitudinal shrinkage	Transversal shrinkage	Thickness
ABS	0.0088	−0.0058	−0.0220
COC	0.0303	0.0126	−0.0410
PP	0.0164	0.0032	−0.0470
HDPE	0.0303	0.0126	−0.0410
PE/PP blend	0.0207	0.0015	−0.0340
PA11	0.0164	0.0032	−0.0470
TPU			

Table 5: Weight and density of ASTM samples.

Samples	**Weight** (g)	**Density** (g/cm^3)
ABS	14.78	$1.04-1.12$
COC	14.07	1.02
PP	12.28	$0.85-0.94$
HDPE	12.73	$0.93-0.97$
PE/PP blend	13.3	$0.86-0.95$
PA11	14.00	1.04
TPU	17.16	$1.23-1.35$