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GoToS3

Elasto-Plast

Improvement of the impact resistance of polylactide by melt blending with a poly(ether-ester) thermoplastic elastomer

16/03/2021



Cofinanciering



Projectleider

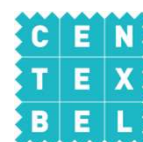
Chef de file

Partners

Partenaires

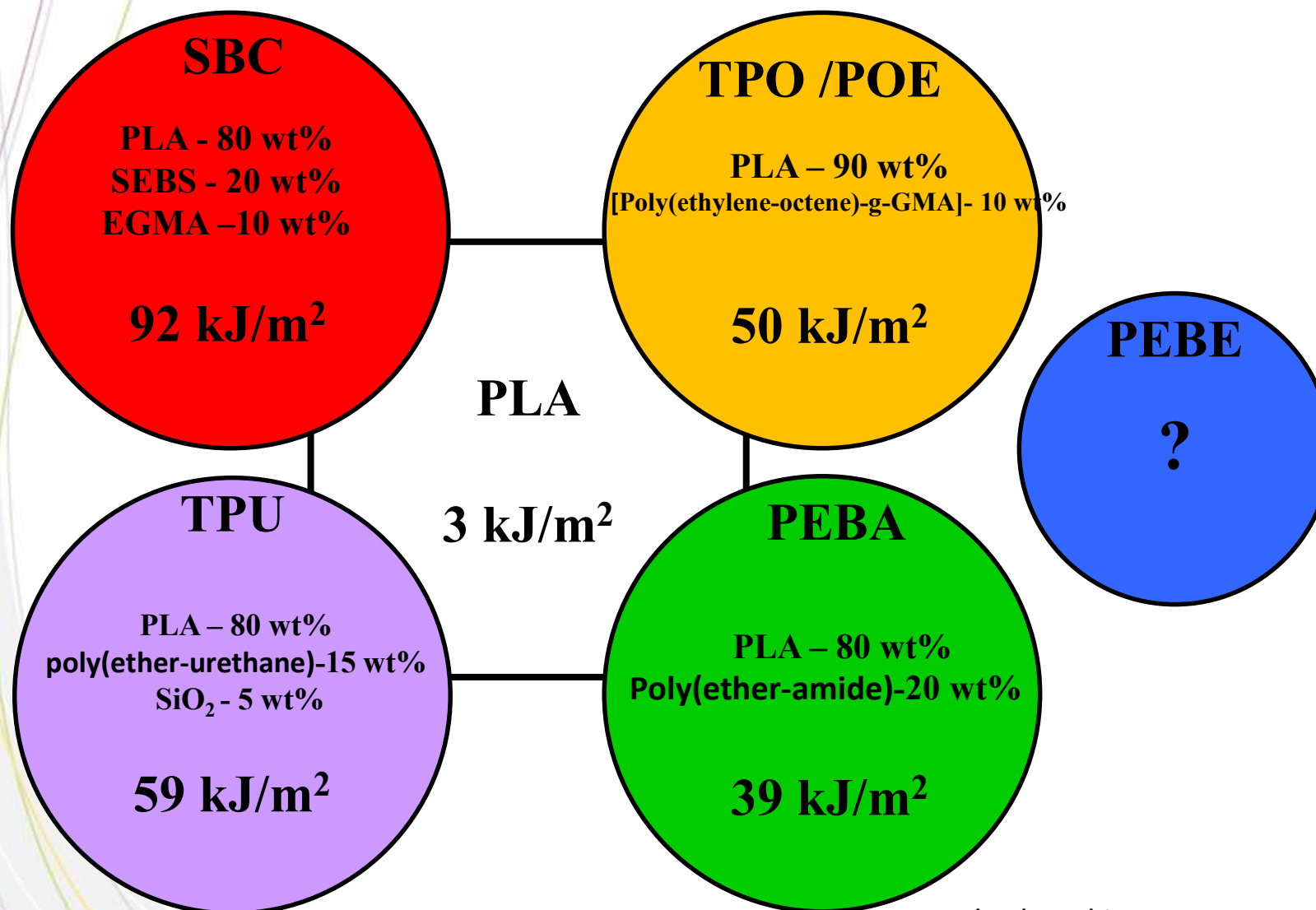
Geassocieerde partners

Partenaires associés



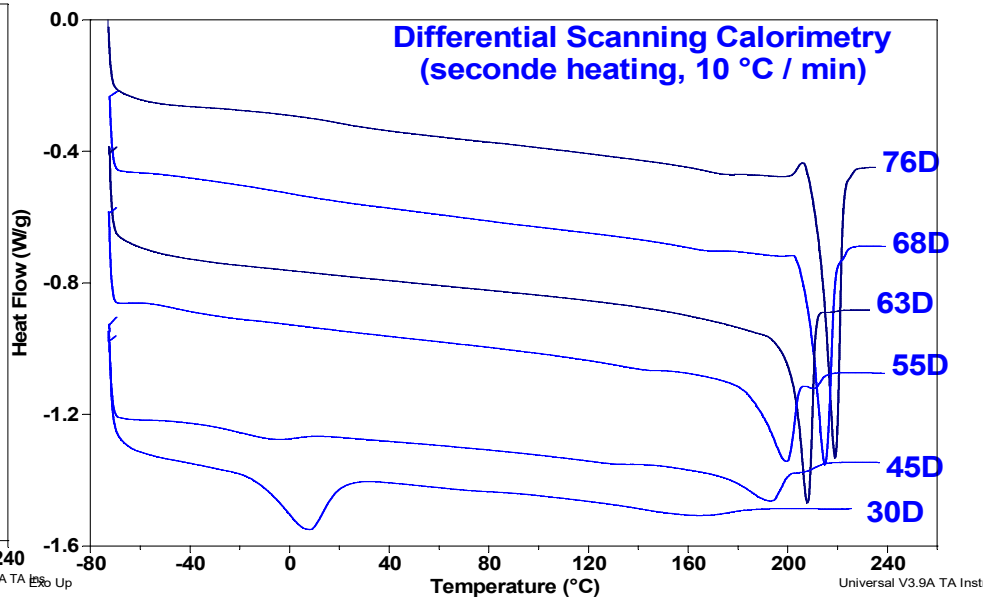
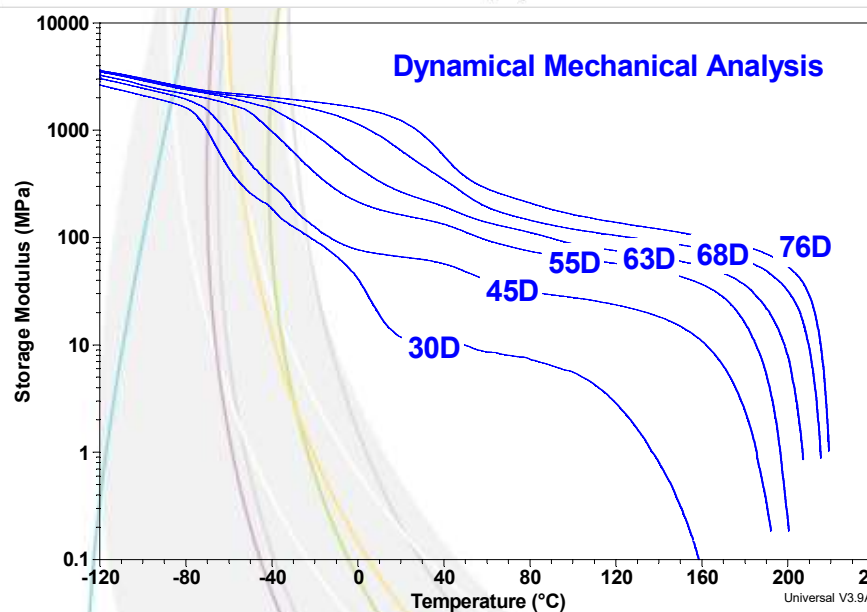
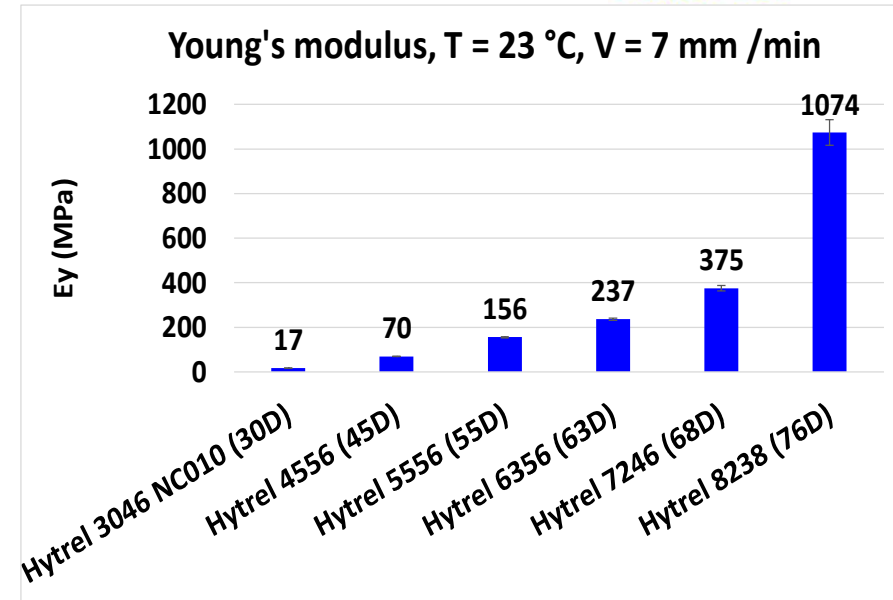
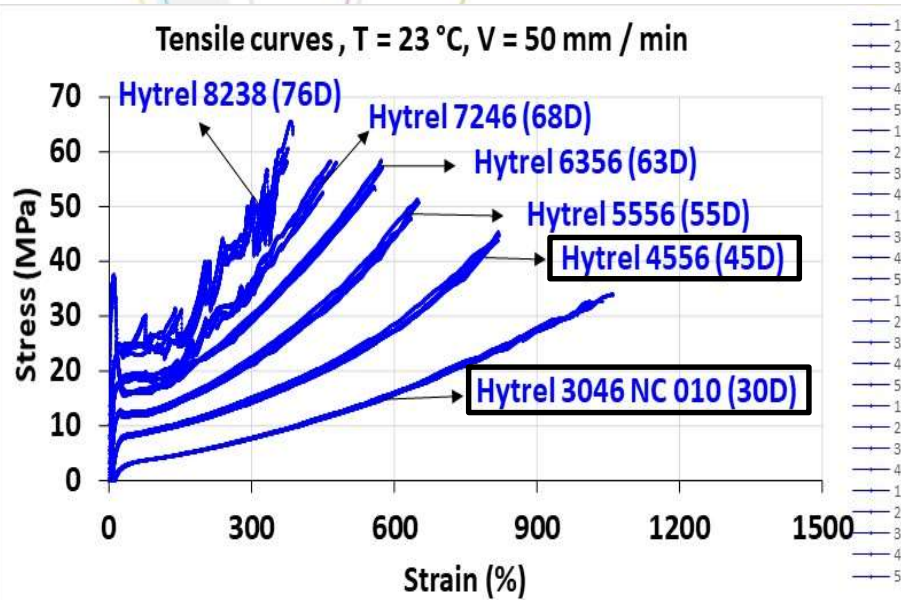
IMPROVEMENT OF THE IMPACT RESISTANCE OF PLA BY MELT BLENDING WITH A TPE

FEW REMARKABLE RESULTS OF THE LITTERATURE



Notched Izod impact energy

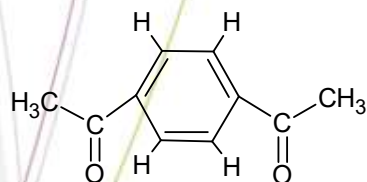
HYTREL® GRADES CHARACTERIZATION (RESULTS OBTAINED DURING THE FIRST TWO YEARS)





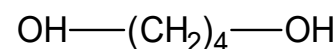
SYNTHESIS AND STRUCTURE OF POLY(ETHER-ESTER)

Dimethyl terephthalate (T)

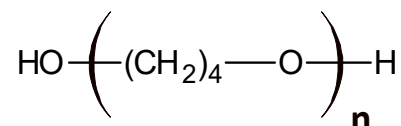


transesterification

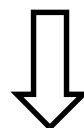
1,4-butanediol (b)



transesterification

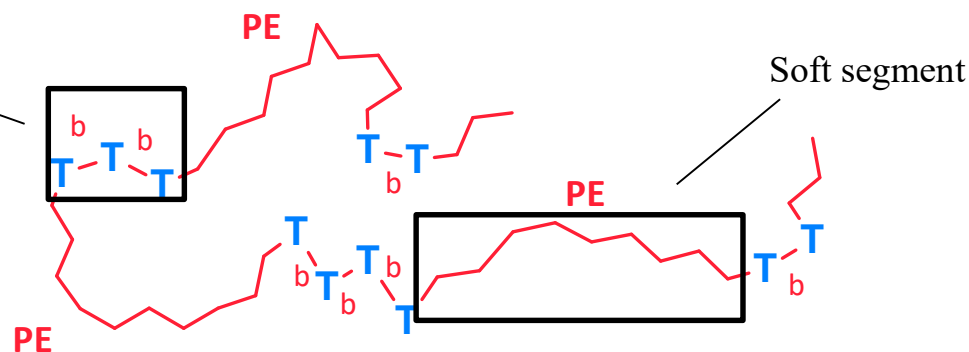


Poly(tetramethylene oxide) (PE)



Multi-blocks copolymer

Hard segment



From ¹ H NMR	Mass composition (%)		
	T	b	PE
Hytel 4556 (45D)	35	14	51 (Mn = 1270 g/mol)
Hytel 3046 NC010 (30D)	19	7	74 (Mn = 1868 g/mol)

BLEND S PLA / HYTREL

COMPOSITION

	PLA 4032D	Hytrel 3046 NC 010
PLA / 3046 - 10 %	90	10
PLA / 3046 - 15 %	85	15
PLA / 3046 - 20 %	80	20
PLA / 3046 - 25 %	75	25
PLA / 3046 - 30 %	70	30

	PLA 4032D	Hytrel 4556
PLA / 4556 - 10 %	90	10
PLA / 4556 - 20 %	80	20
PLA / 4556 - 30 %	70	30

BLEND PLA / HYTREL

PREPARATION BY EXTRUSION

Feeder with dry pellets
of PLA 4032D

Feeder with dry pellets of
HYTREL 3046 NC 010 or Hytrel 4556



Twin screw extruder (D=18 mm, L/D= 50)
Screw speed = 200 rpm
Tmelt (°C) = 200 – 210 - 190
Throughput = 2 kg /h
Residence time = 4 min

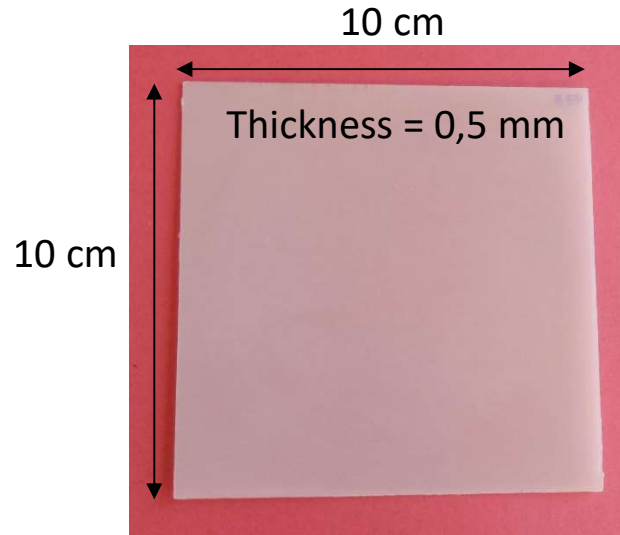
Pelletizer

Water bath

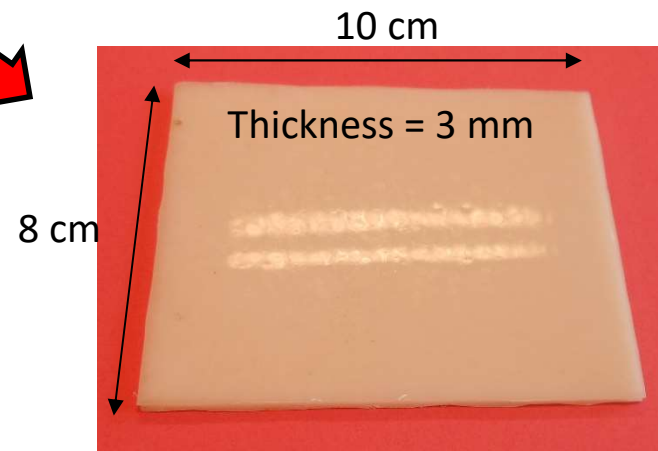
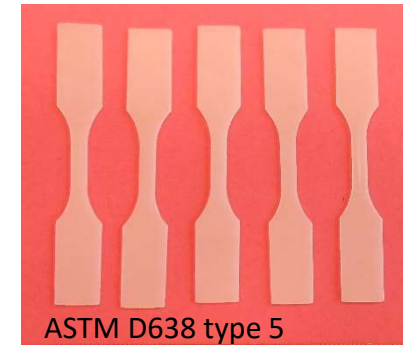


TENSILE AND IMPACT SPECIMENS PREPARATION BY COMPRESSION MOLDING

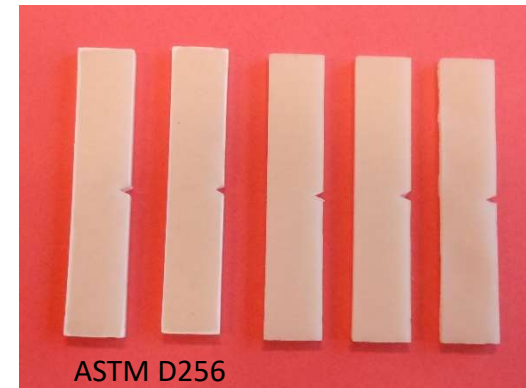
Pellets of compound



Tensile specimens



Notched Impact specimens



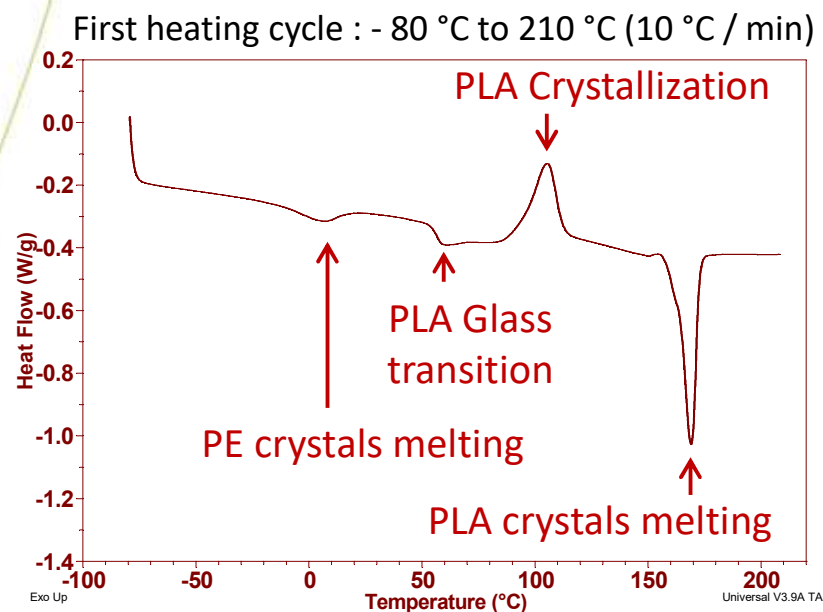
➡ Compression molding : T = 220 °C – 240°C

➡ Hydraulic press with cutter

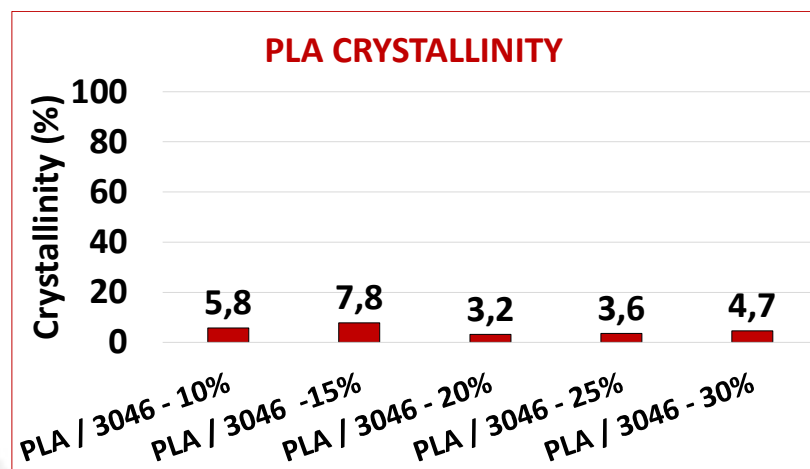
CHARACTERIZATION OF SPECIMENS PLA/HYTREL 3046 NC 010

DIFFERENTIAL SCANNING CALORIMETRIY (DSC)

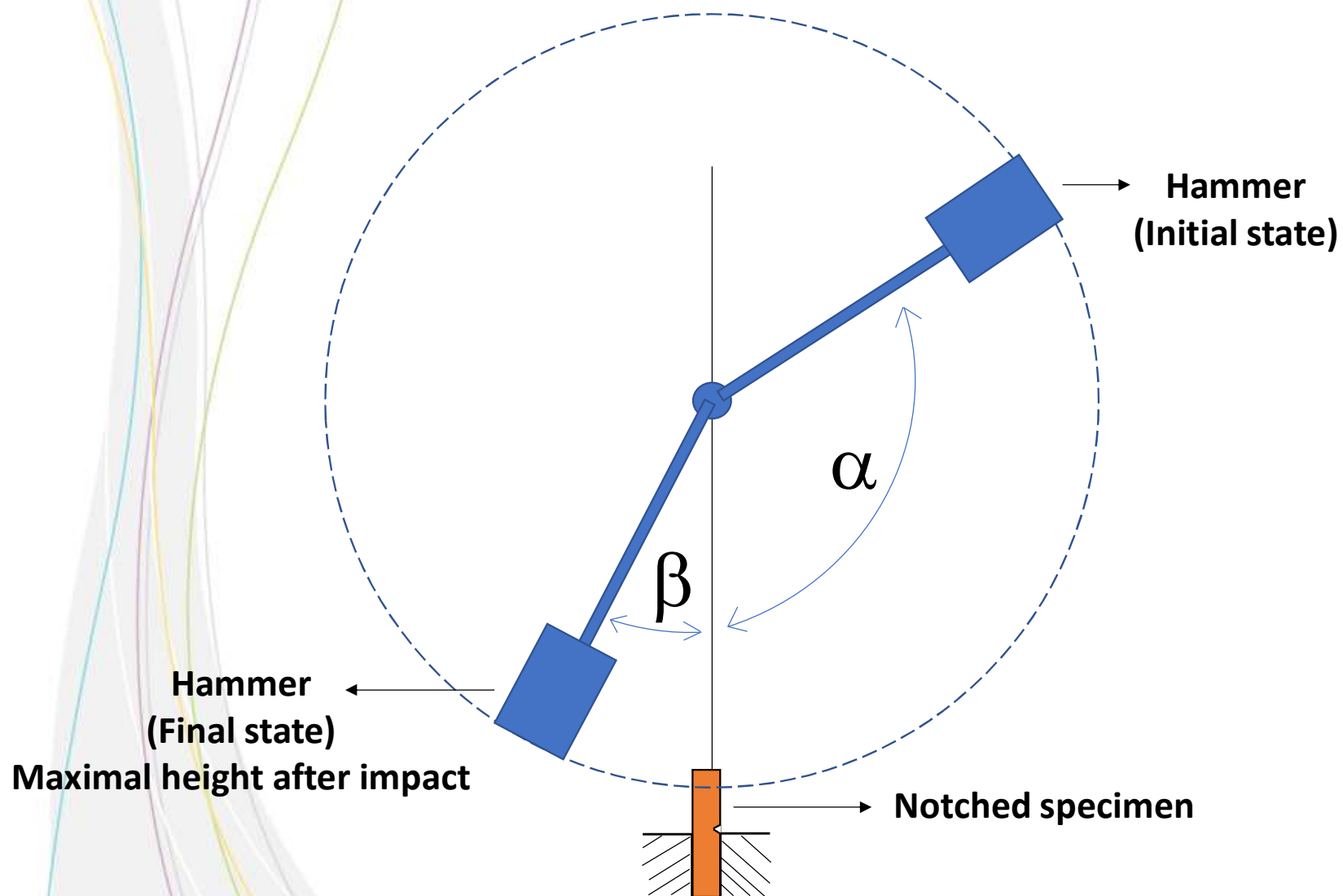
PLA / 3046 – 30 %



PLA crystallinity = 4,7 %



Izod Impact test

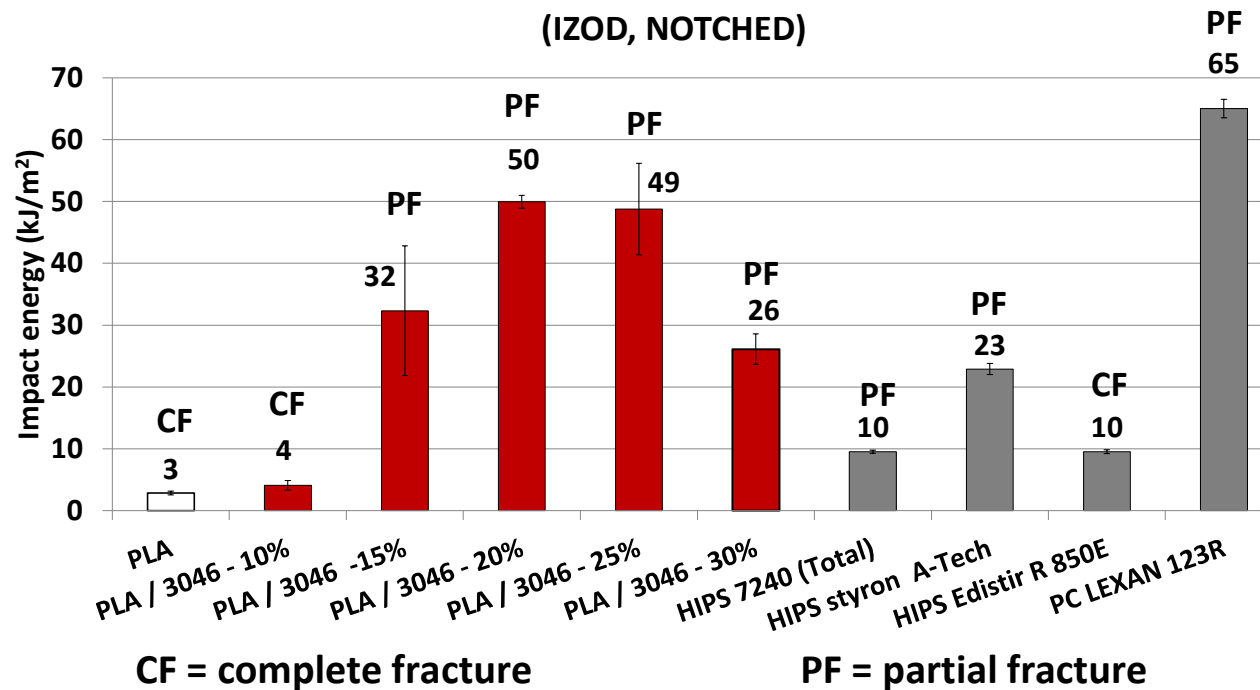


CHARACTERIZATION OF SPECIMENS PLA/HYTREL 3046 NC 010

IMPACT ENERGY

ASTM D256

IMPACT ENERGY AT 23 °C
(IZOD, NOTCHED)



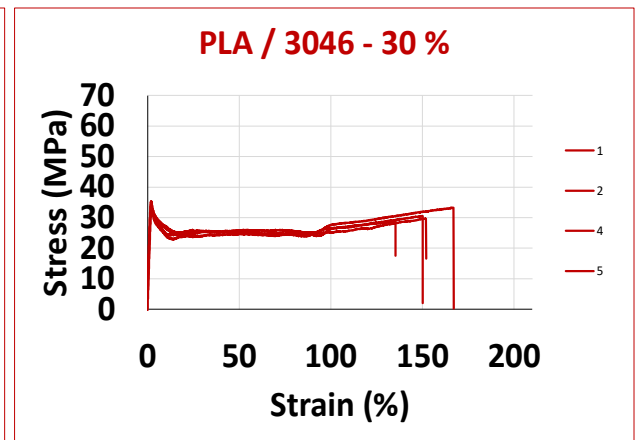
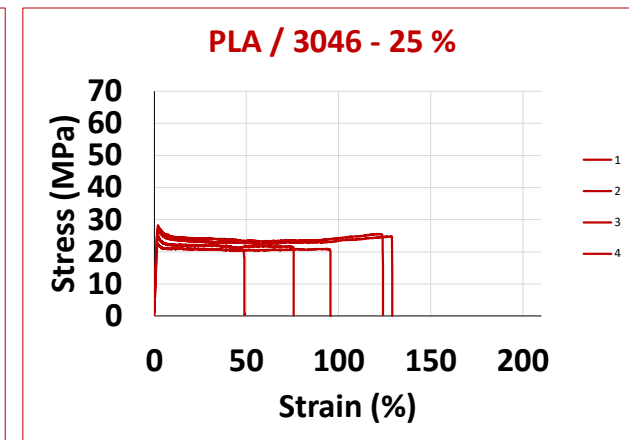
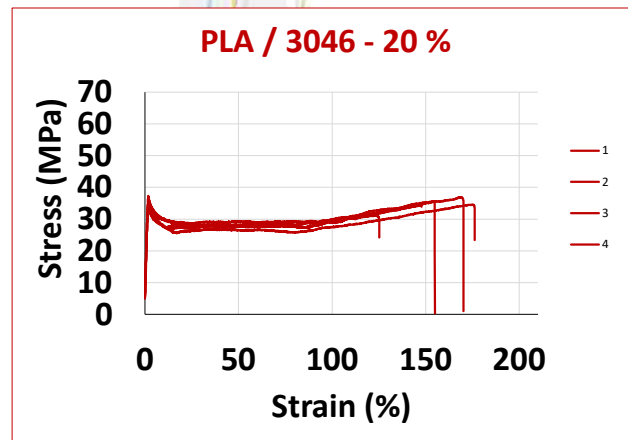
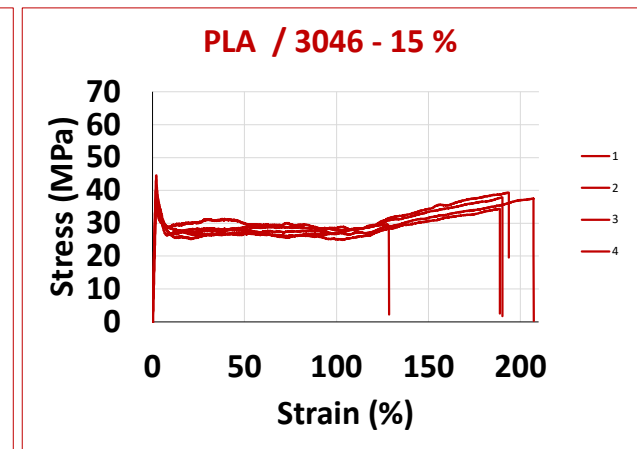
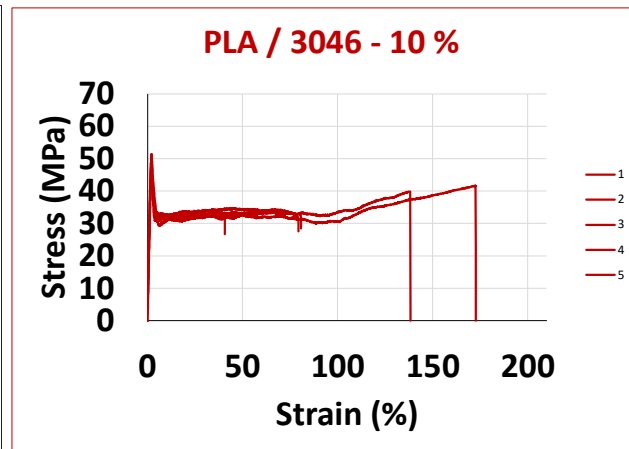
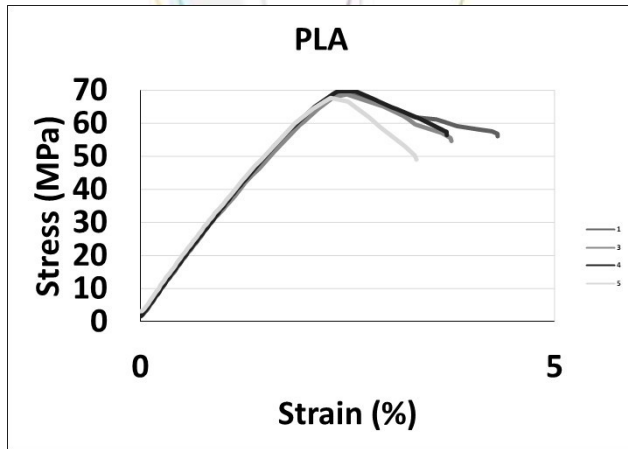
Specimens after impact test

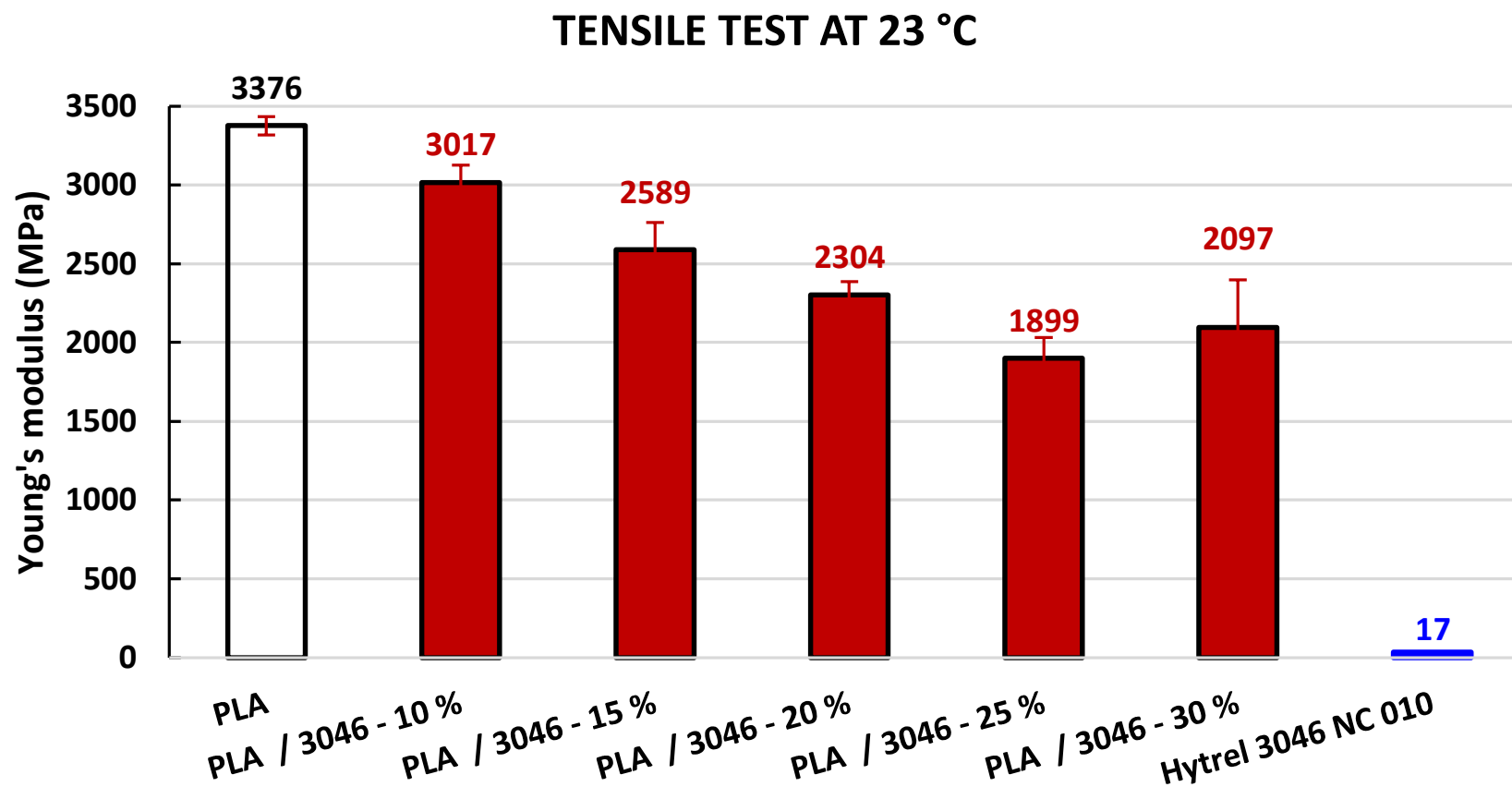
PLA



PLA / 3046 - 20 %

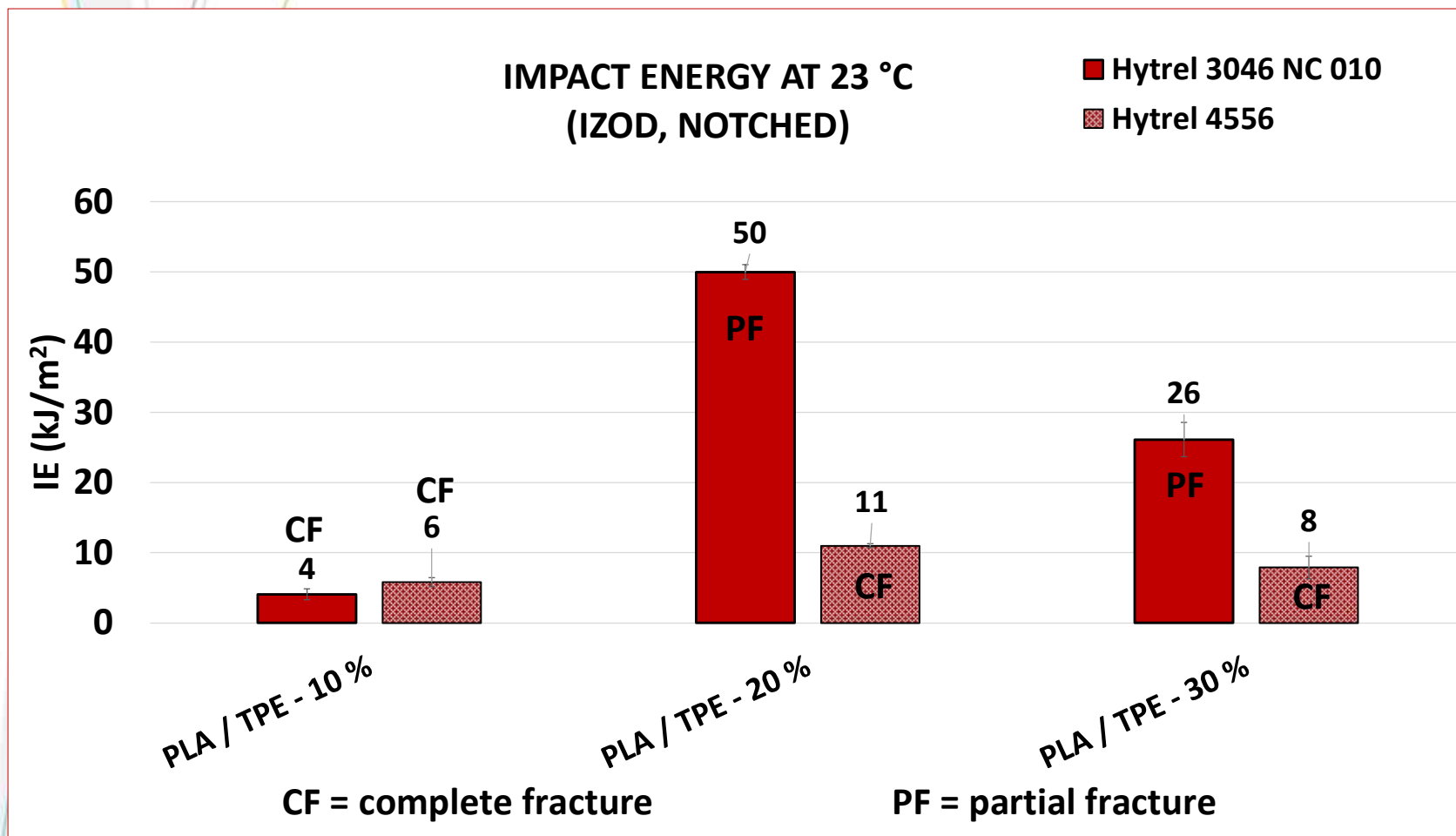
TENSILE TESTS ($v = 10 \text{ mm / min}$)





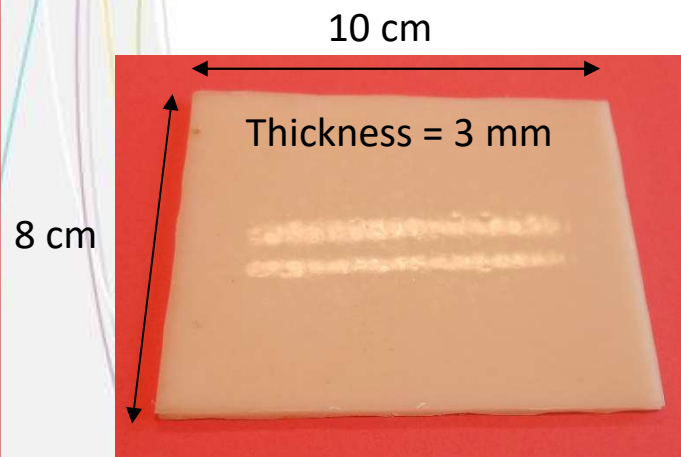
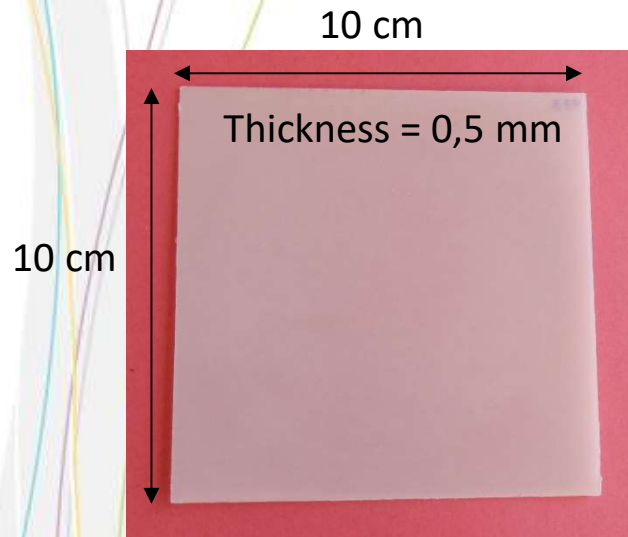
COMPARISON [PLA / HYTREL 3046 NC 010] ↔ [PLA / HYTREL 4556]

IMPACT ENERGY

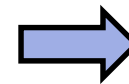


ANNEALING OF THE SHEETS COMPOSED OF PLA AND HYTREL 3046 NC 010

**Annealing of the sheets in an oven
(105 °C for 30 min)**



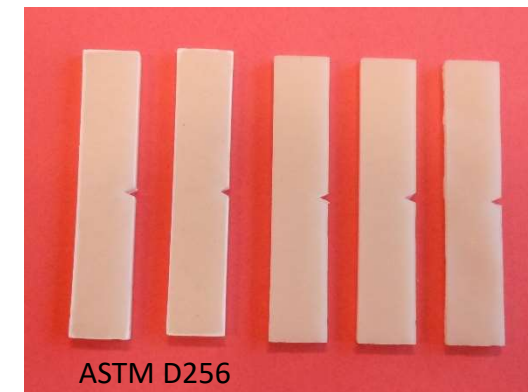
Hydraulic press
with cutter



Tensile specimens

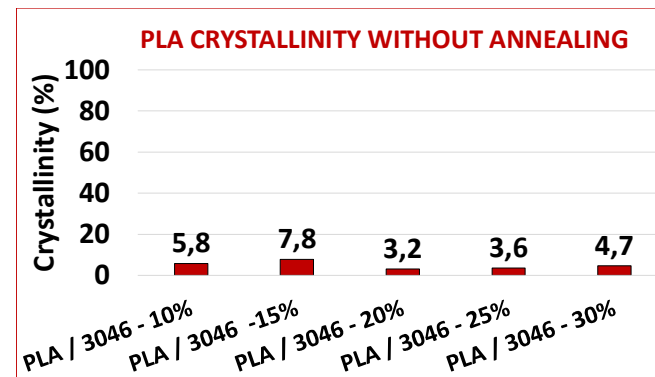
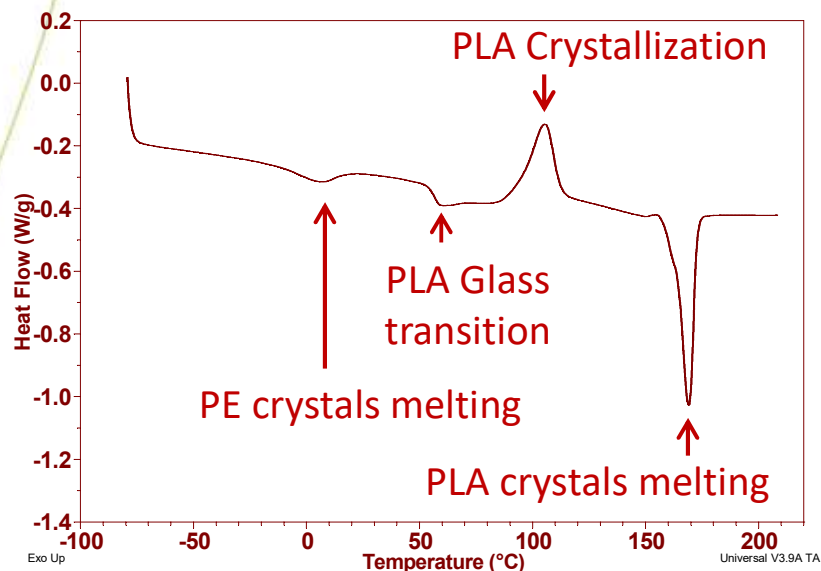


Notched Impact specimens

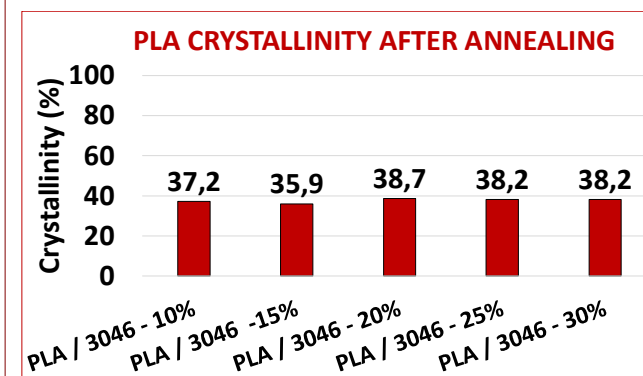
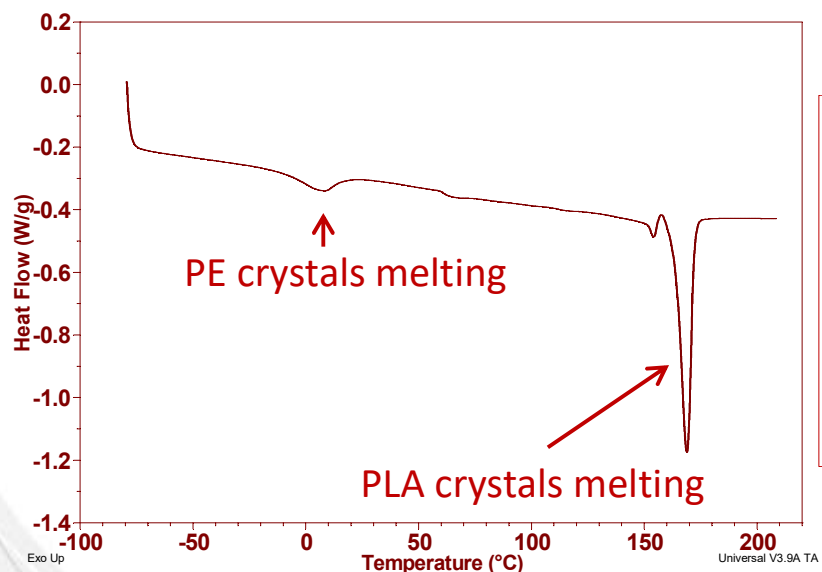
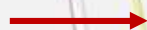


ANNEALED SPECIMENS PLA / HYTREL 3046 NC 010 DIFFERENTIAL SCANNING CALORIMETRIY (DSC)

PLA / 3046 – 30 %
(without annealing)



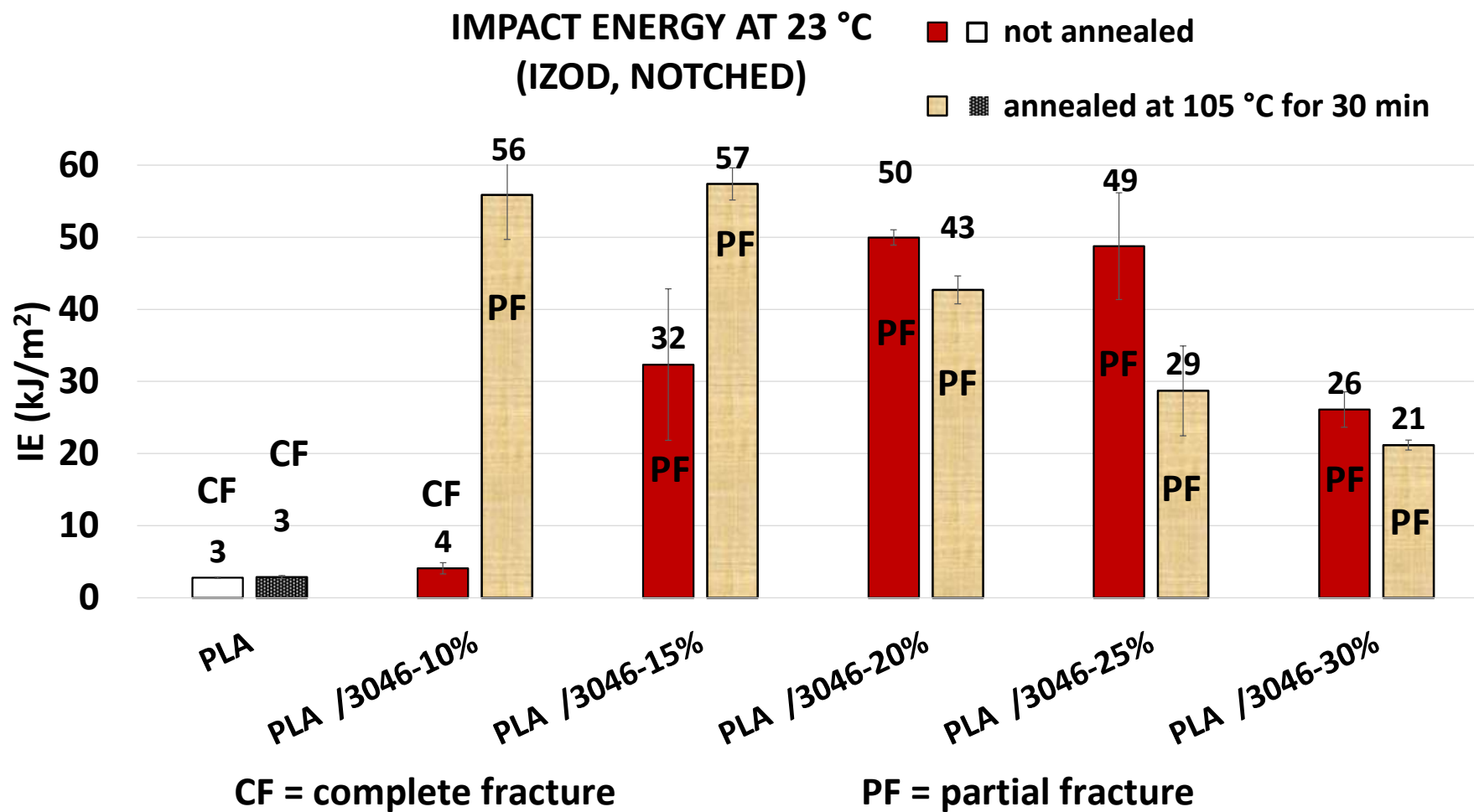
PLA / 3046 – 30 %
annealed



First heating cycle : - 80 °C to 210 °C (10 °C / min)

ANNEALED SPECIMENS PLA / HYTREL 3046 NC 010

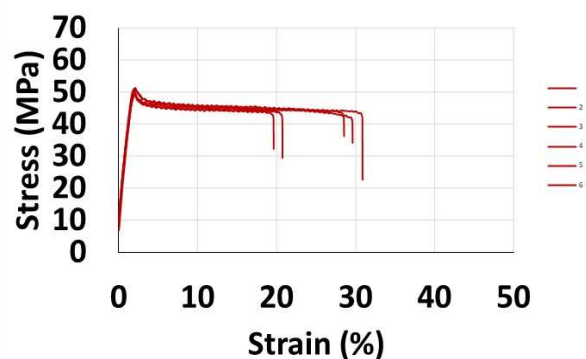
IMPACT ENERGY



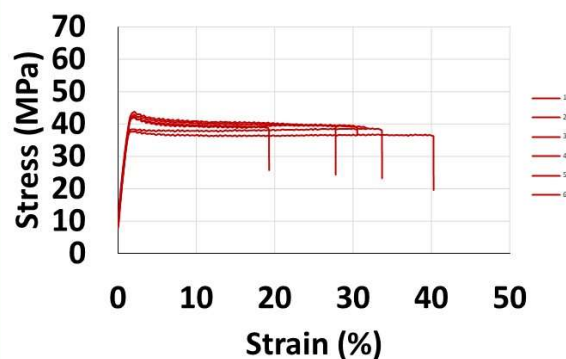
ANNEALED SPECIMENS PLA / HYTREL 3046 NC 010

TENSILE TESTS ($v = 10 \text{ mm / min}$)

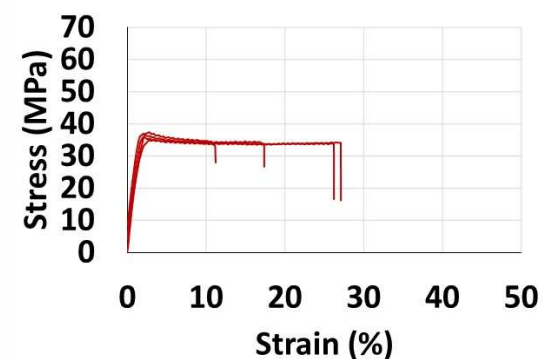
PLA / 3046 - 10 % annealed



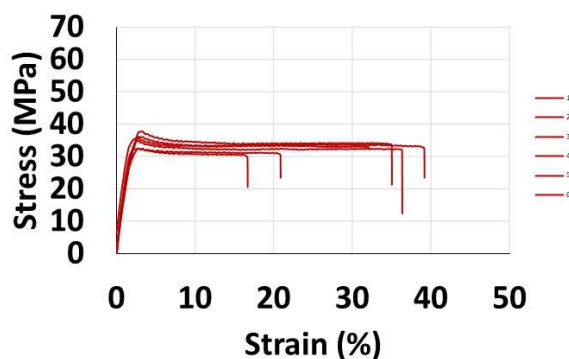
PLA / 3046 - 15 % annealed



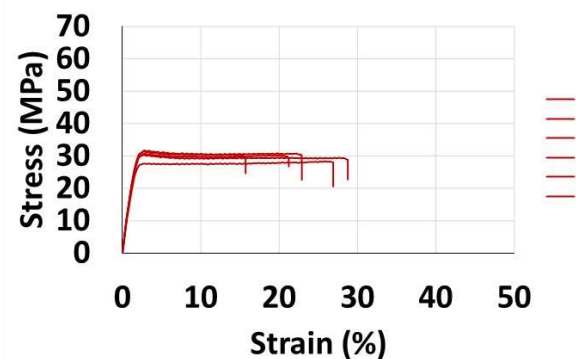
PLA / 3046 - 20 % annealed



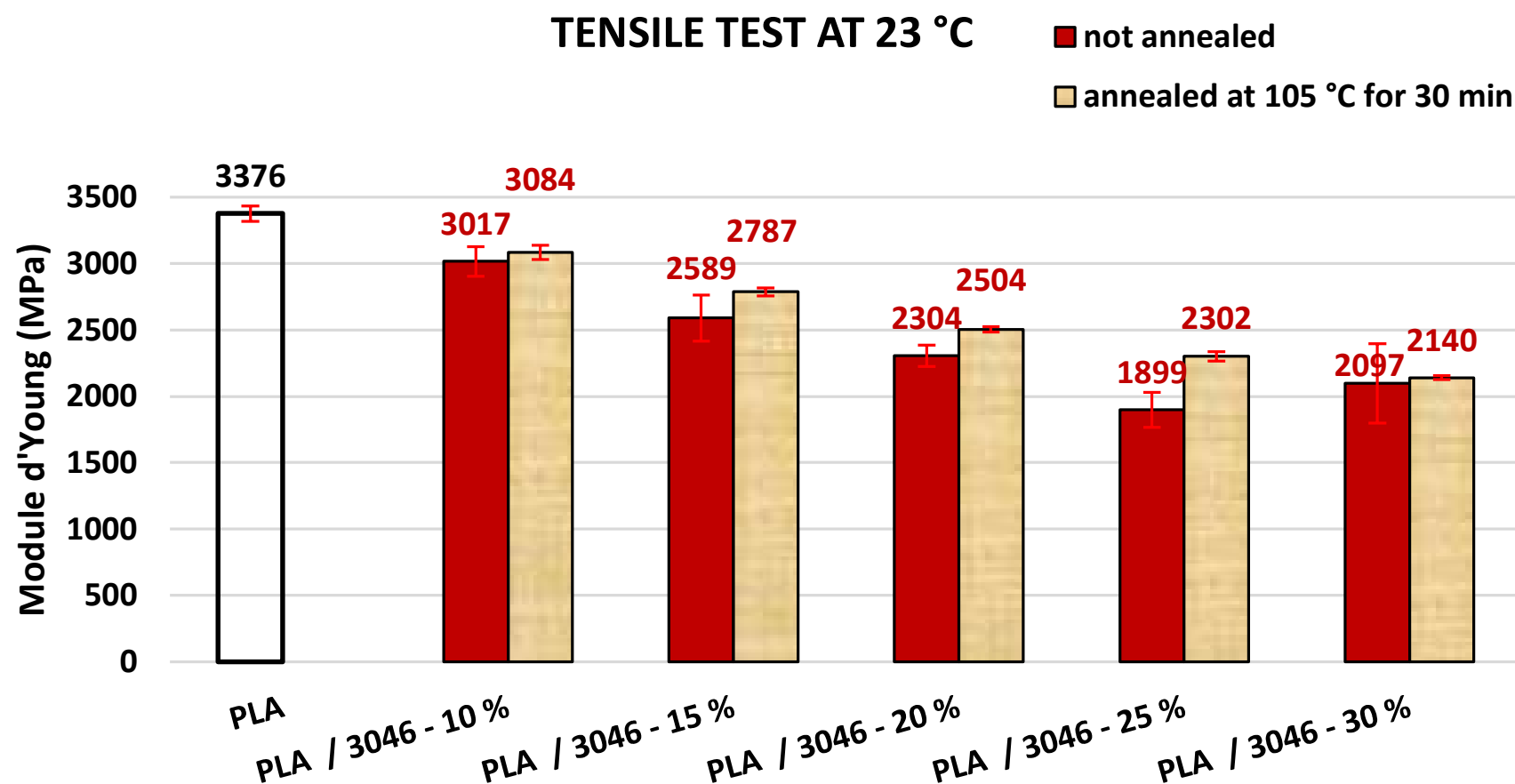
PLA / 3046 - 25 % annealed



PLA / 3046 - 30 % annealed

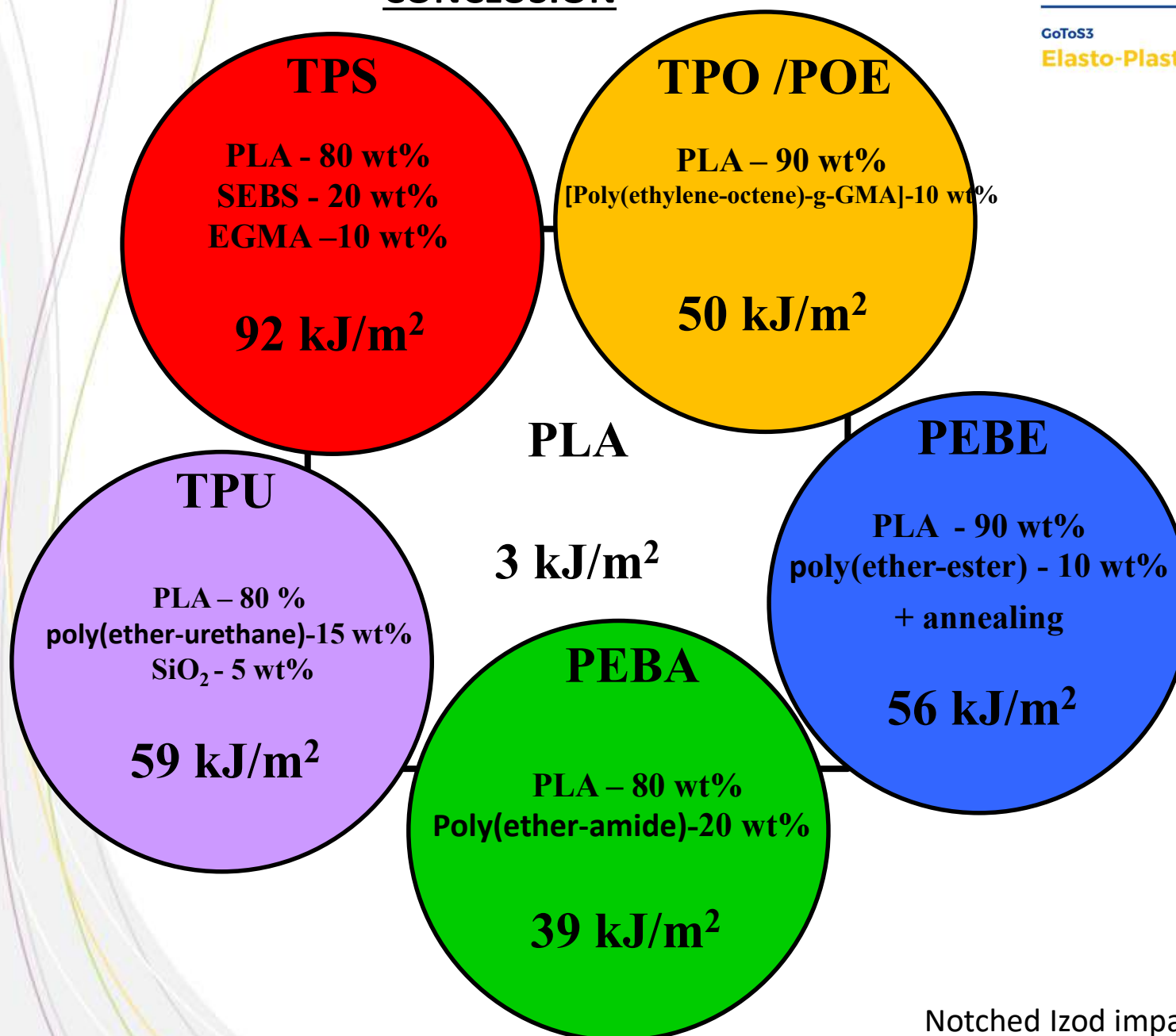


ANNEALED SPECIMENS PLA / HYTREL 3046 NC 010 TENSILE TESTS ($v = 10 \text{ mm / min}$)



IMPROVEMENT OF THE IMPACT RESISTANCE OF PLA

CONCLUSION



Notched Izod impact energy

Thank for your attention

For further information
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Projectleider

Chef de file



Partners

Partenaires



Geassocieerde partners

Partenaires associés

