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Introducción

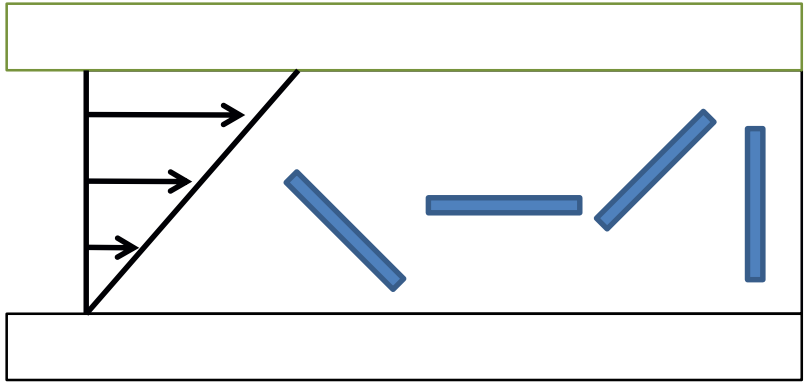
- Material compuesto

Matriz
(Fase Continua)

Fase Dispersa
(Fase Discontinua)

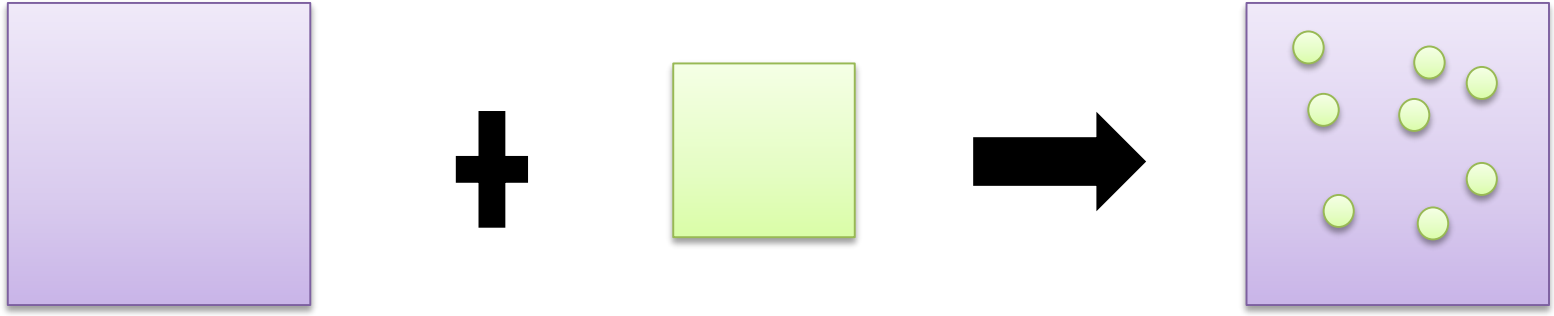
Introducción

- Material compuesto



Introducción

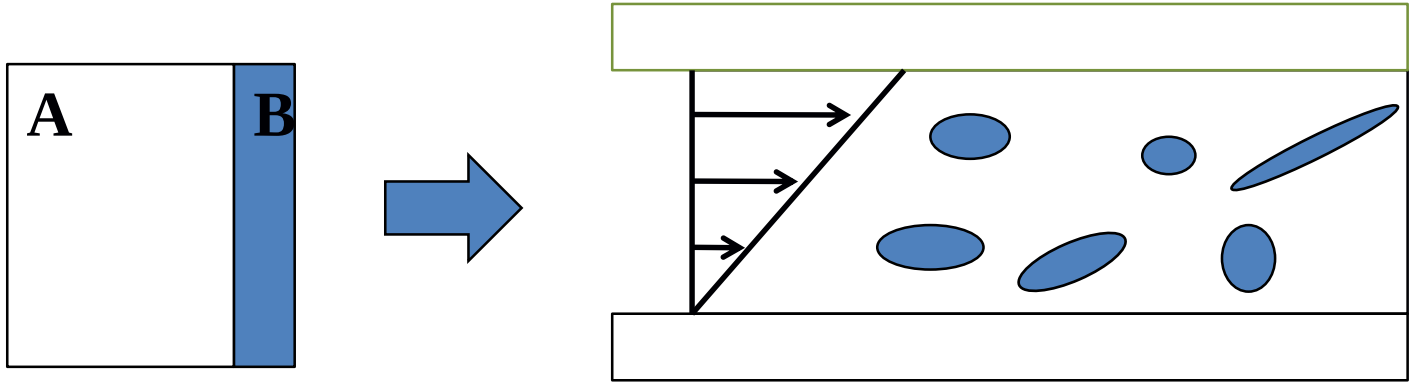
- Mezcla polimérica



Matriz
(Fase continua)

Fase dispersa
(fase discontinua)

- Mezcla polimérica



Introducción

La mayoría de los componentes de los materiales compuestos y de las mezclas poliméricas son inmiscibles.

Introducción

- Poca o nula adhesión interfacial
- Propiedades mecánicas pobres
- Separación de fases/ alta tensión interfacial

Introducción

Estrategia: Compatibilización reactiva o ***in-situ***

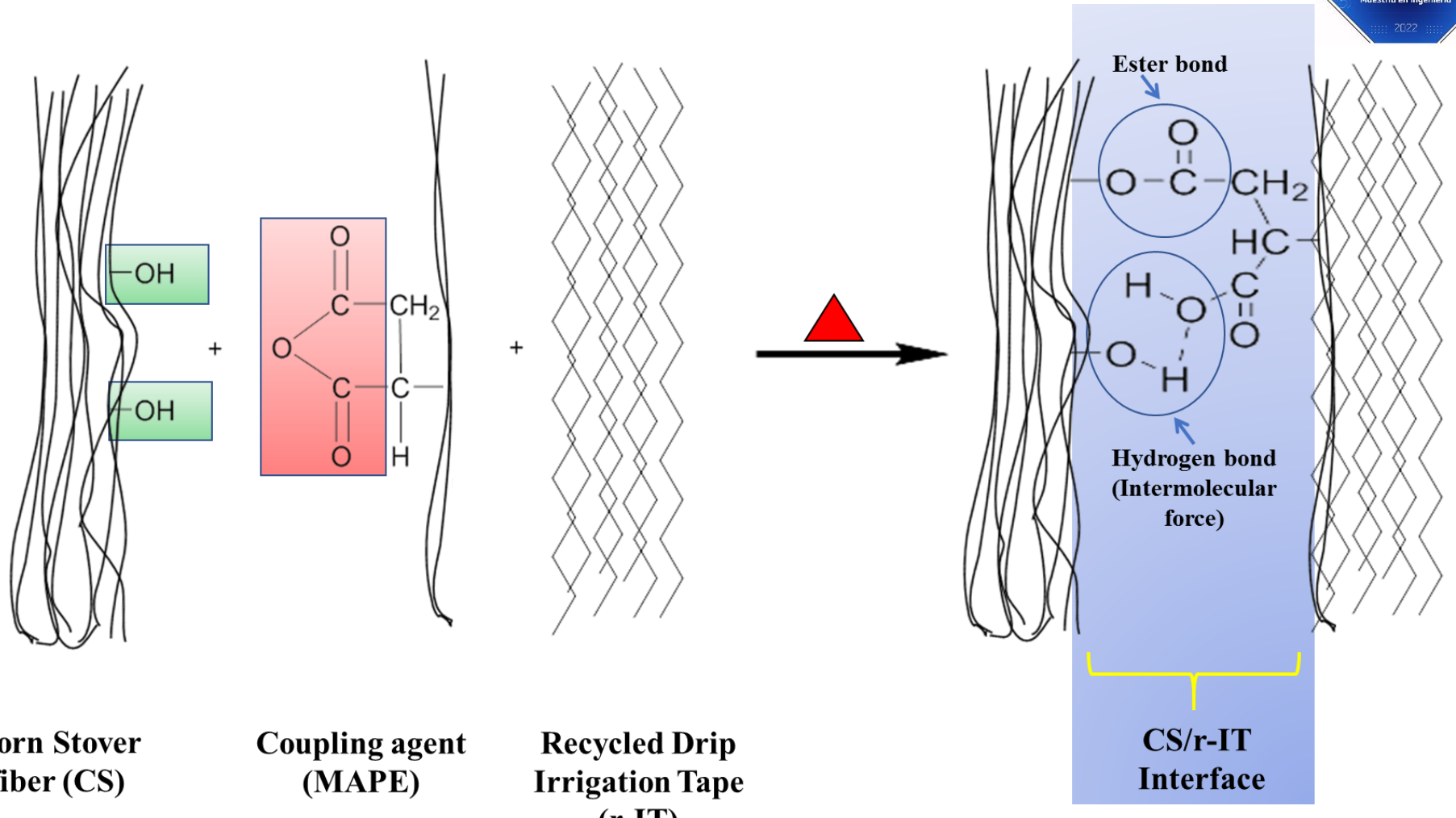
Consiste en la adición de un copolímero que es ***miscible*** con uno de los componentes y que tiene ***grupos funcionales*** que pueden reaccionar con el otro componente para generar el ***compatibilizante in-situ*** durante el mezclado en fundido.

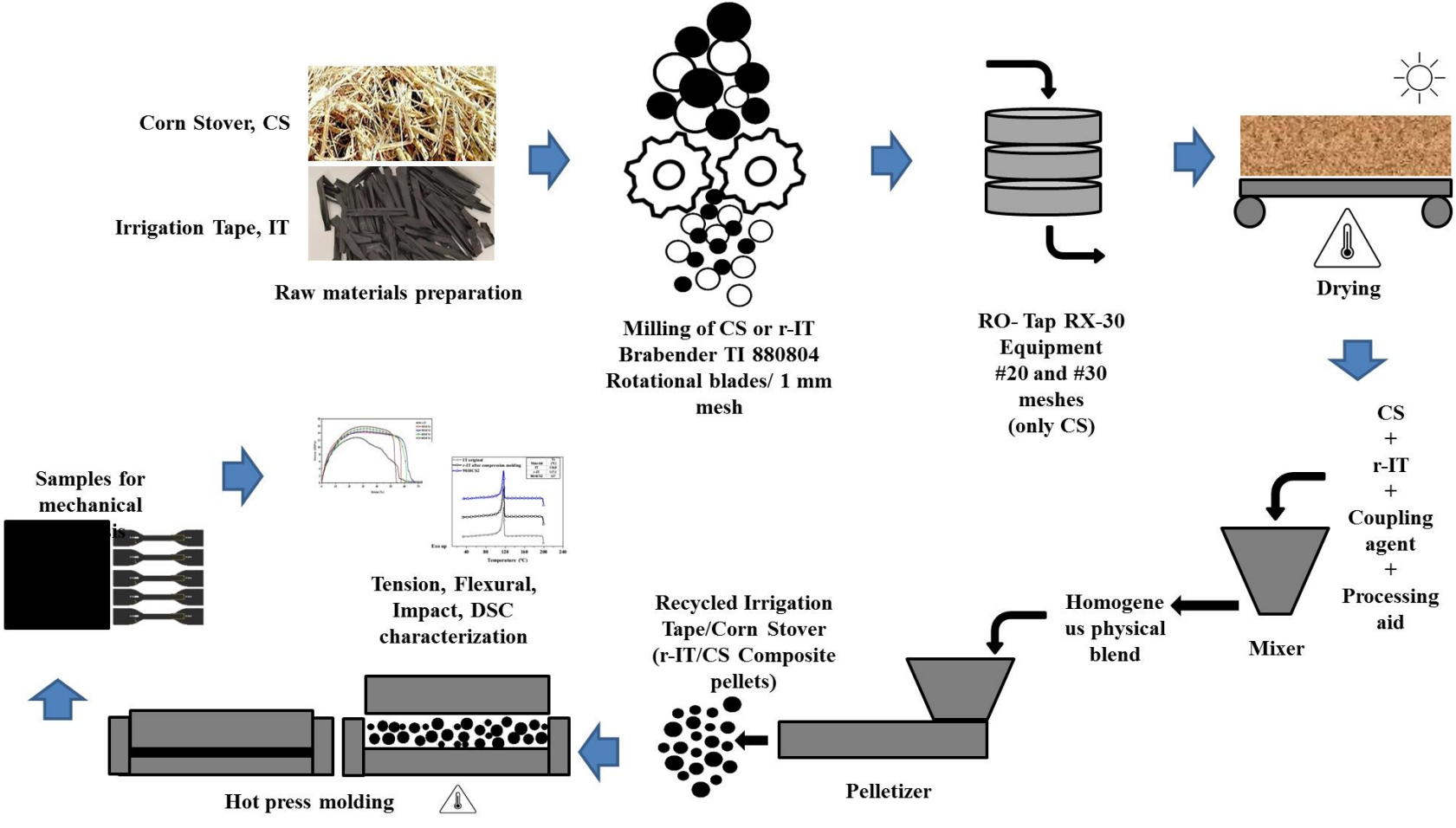
Caso de estudio: 1

Development of Composite Materials from Recycled Irrigation Tape and Corn Stover

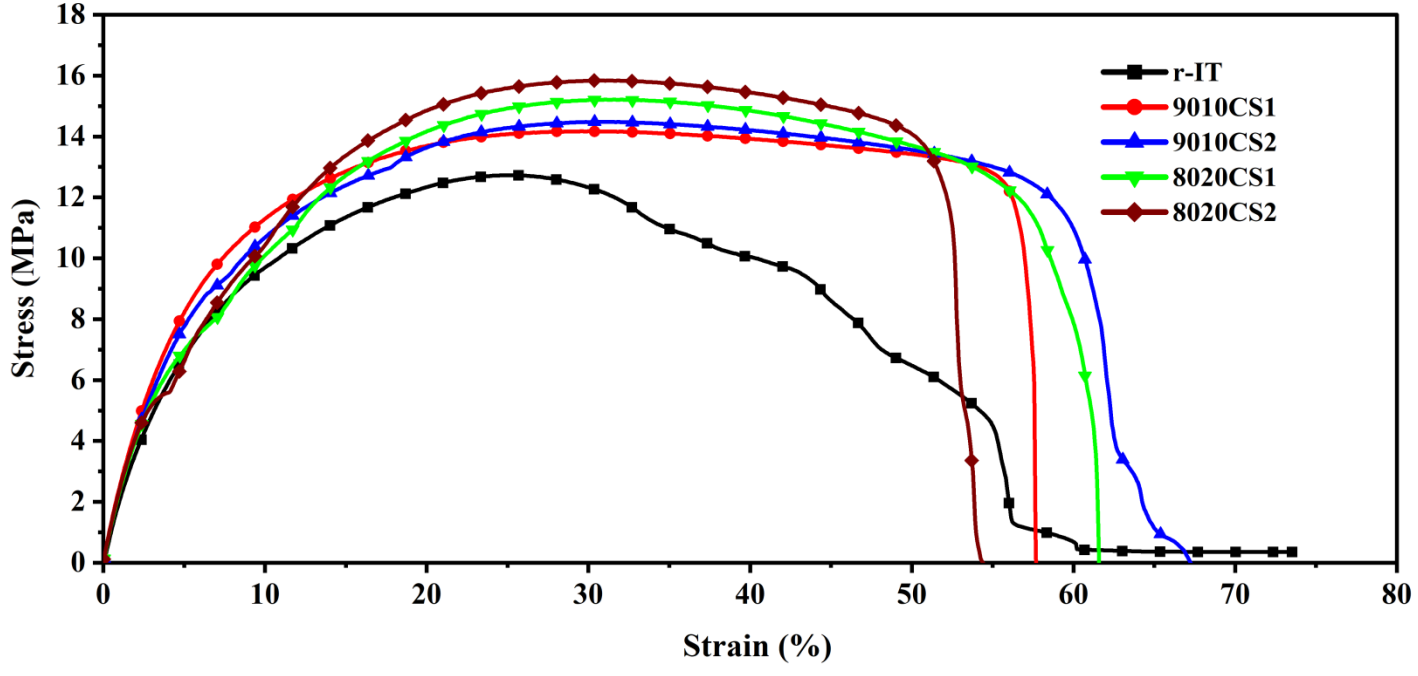
Table 1. Percentages of the raw materials used for the compounding. *Source: Own elaboration.*

Material	IT (wt%)	CS1 (wt%)	CS2 (wt%)	Polybond 3029 (wt%)	TPW 104 (wt%)
r-IT	100				
9010CS1	90		10	5	5
9010CS2	90	10		5	5
8020CS1	80		20	5	5
8020CS2	80	20		5	5

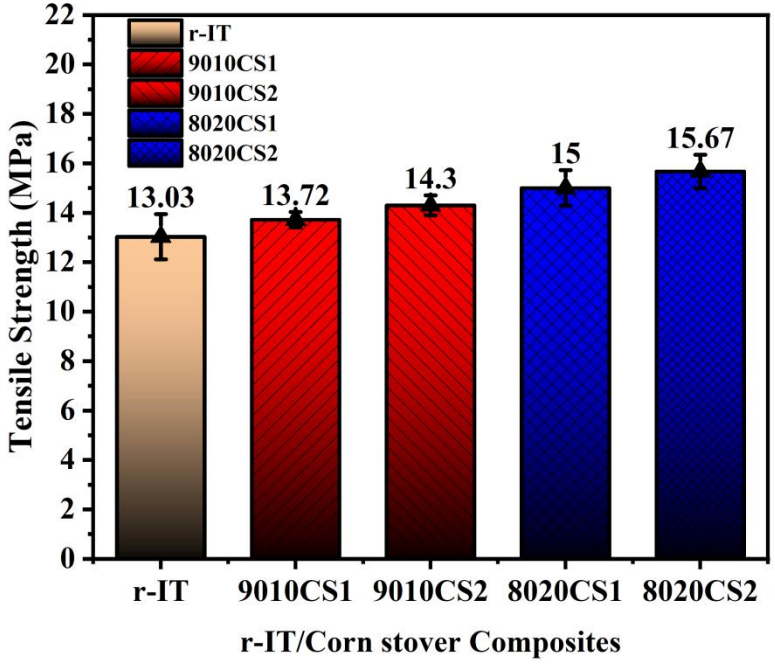

OH
OH
+
O
C
CH2
O
C
C
O
H
+
Ester bond
O
O
C
CH2
HC
C
O
H
O
O
H
Hydrogen bond
(Intermolecular
force)
CS/r-IT
Interface
Corn Stover
fiber (CS)
Coupling agent
(MAPE)
Recycled Drip
Irrigation Tape
(r-IT)

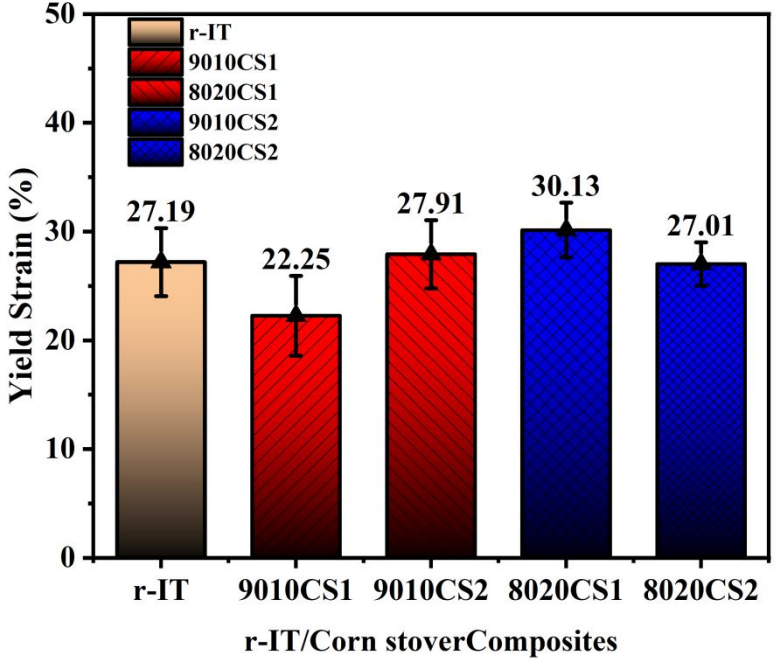

Corn Stover, CS
Irrigation Tape, IT
Raw materials preparation
Milling of CS or r-IT
Brabender TI 880804
Rotational blades/ 1 mm
mesh
RO- Tap RX-30
Equipment
#20 and #30
meshes
(only CS)
Drying
CS
+
r-IT
+
Coupling
agent
+
Processing
aid
Mixer
Homogene
us physical
blend
Recycled Irrigation
Tape/Corn Stover
(r-IT/CS Composite
pellets)
Pelletizer
Hot press molding
Tension, Flexural,
Impact, DSC
characterization
Samples for
mechanical

Results: Tensile Mechanical properties

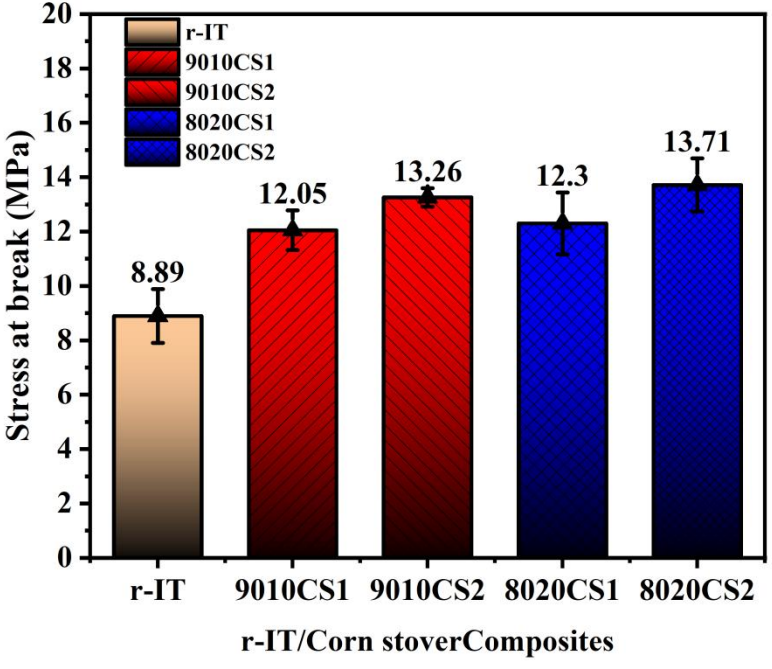


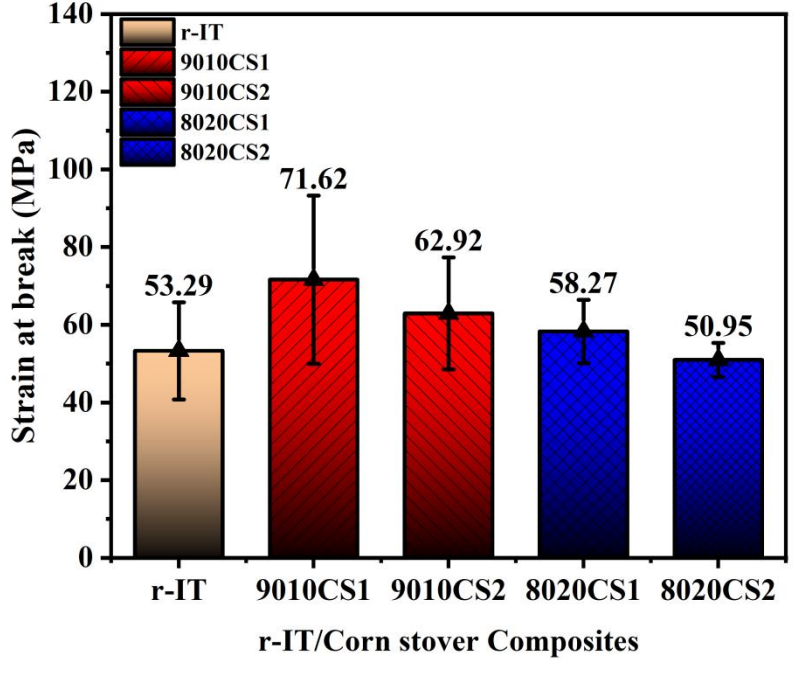
Results: Tensile Mechanical properties



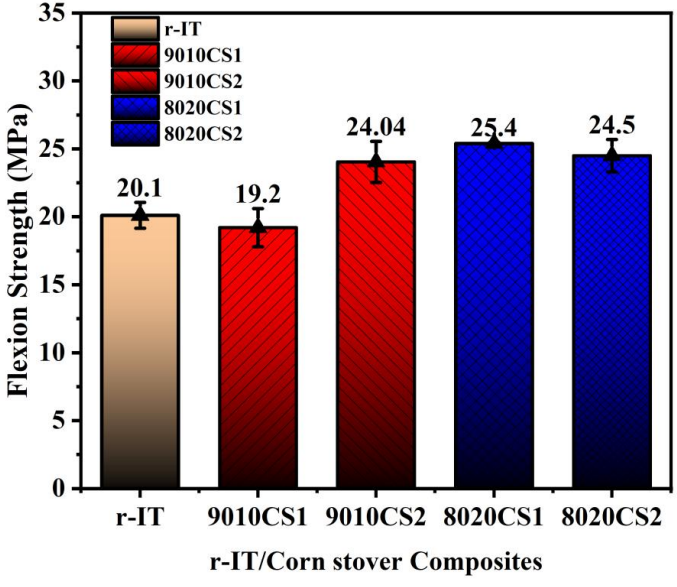


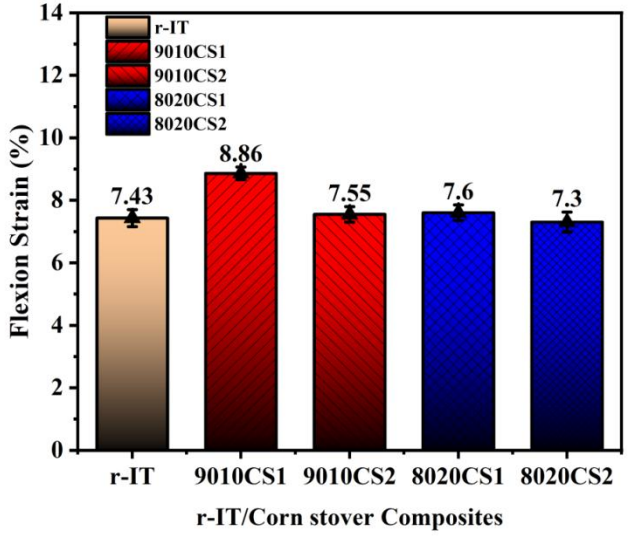
Results: Tensile Mechanical properties

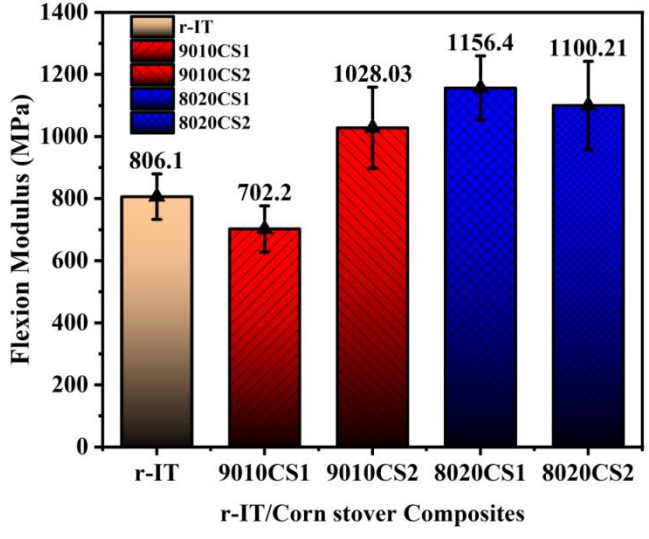




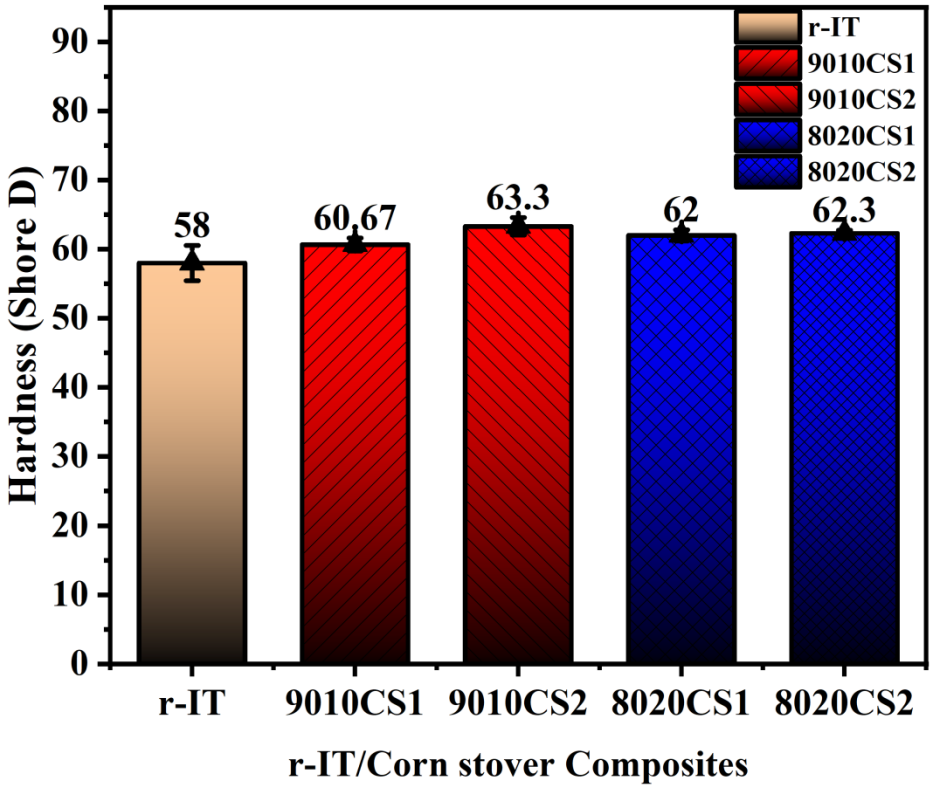
Results: Flexion



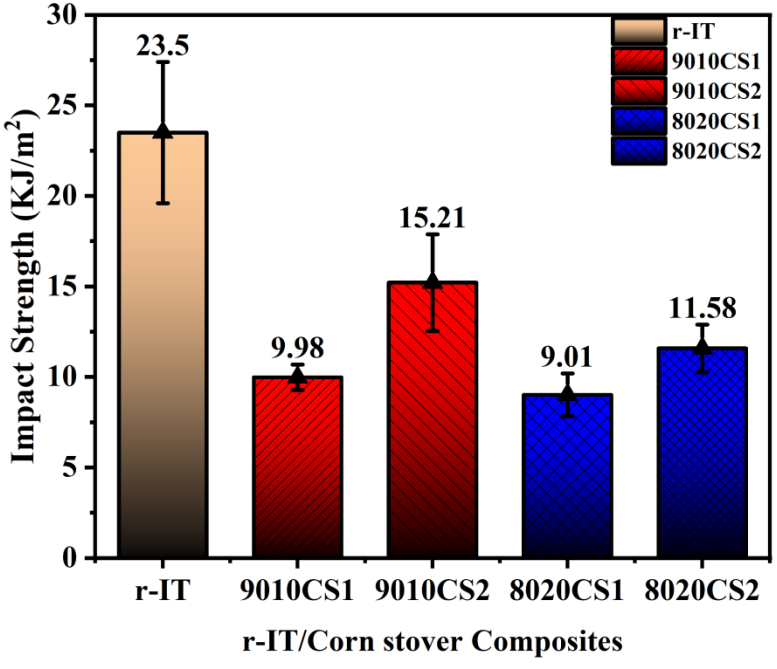


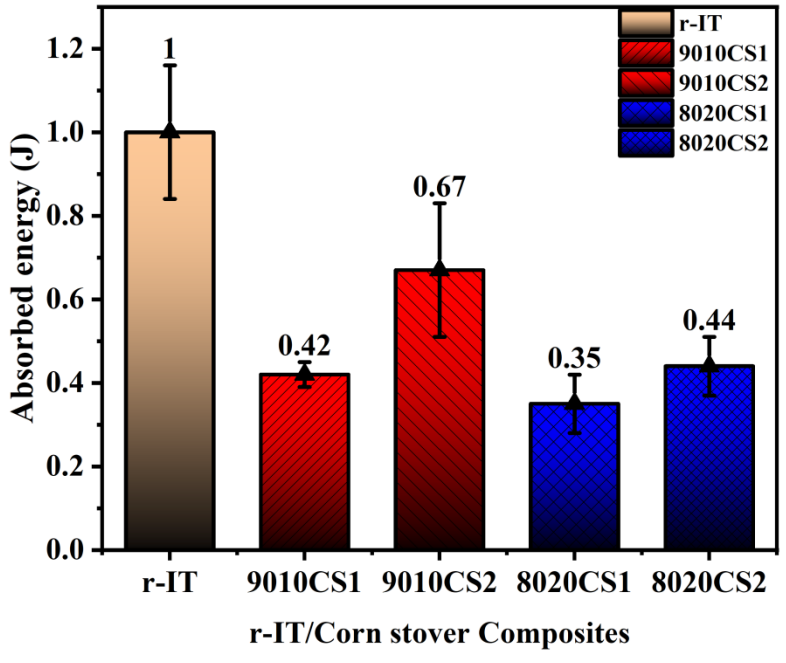


Results: Hardness

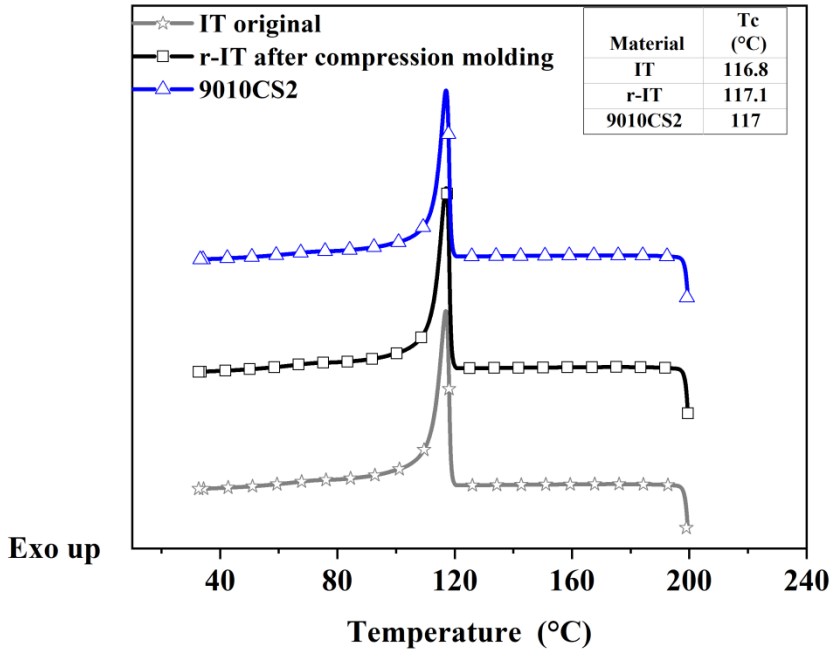


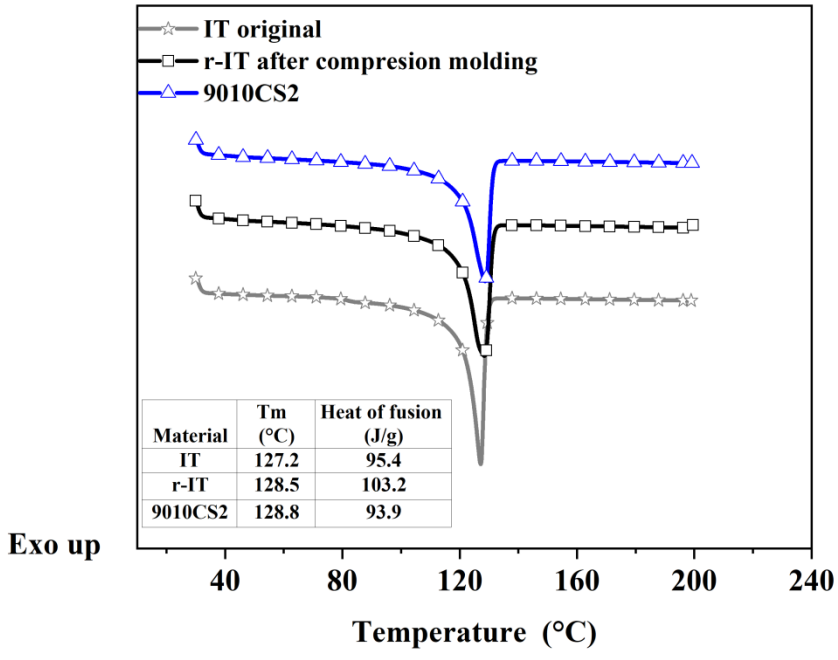
Results: Impact





Results: DSC


IT original
r-IT after compression molding
9010CS2
Material | Tc (°C)
IT | 116.8
r-IT | 117.1
9010CS2 | 117
Exo up
40
80
120
160
200
240
Temperature (°C)


IT original
r-IT after compresion molding
9010CS2
Material | Tm (°C) | Heat of fusion (J/g)
IT | 127.2 | 95.4
r-IT | 128.5 | 103.2
9010CS2 | 128.8 | 93.9
Exo up
40
80
120
160
200
240
Temperature (°C)

Conclusions

- Polymer composites were prepared by extruding and compressing recycled Irrigation Tape (r-IT) and Corn Stover fibers (CS). The composite formulations consist of concentrations of 10% and 20% CS fibers with two different particle sizes (CS1 and CS2) and a 5% of MAPE Coupling Agent.
- Increased CS loading or length increases the tensile, bending, and hardness properties. However, there is a noticeable decrease in the impact of properties.
- DSC results showed that the CS fibers addition reduced the percentage of crystallinity.
- Rheology, morphology, and concentration of the coupling agent in composite materials analyses are additional variables that need to be studied in the future.

Caso de estudio: 2

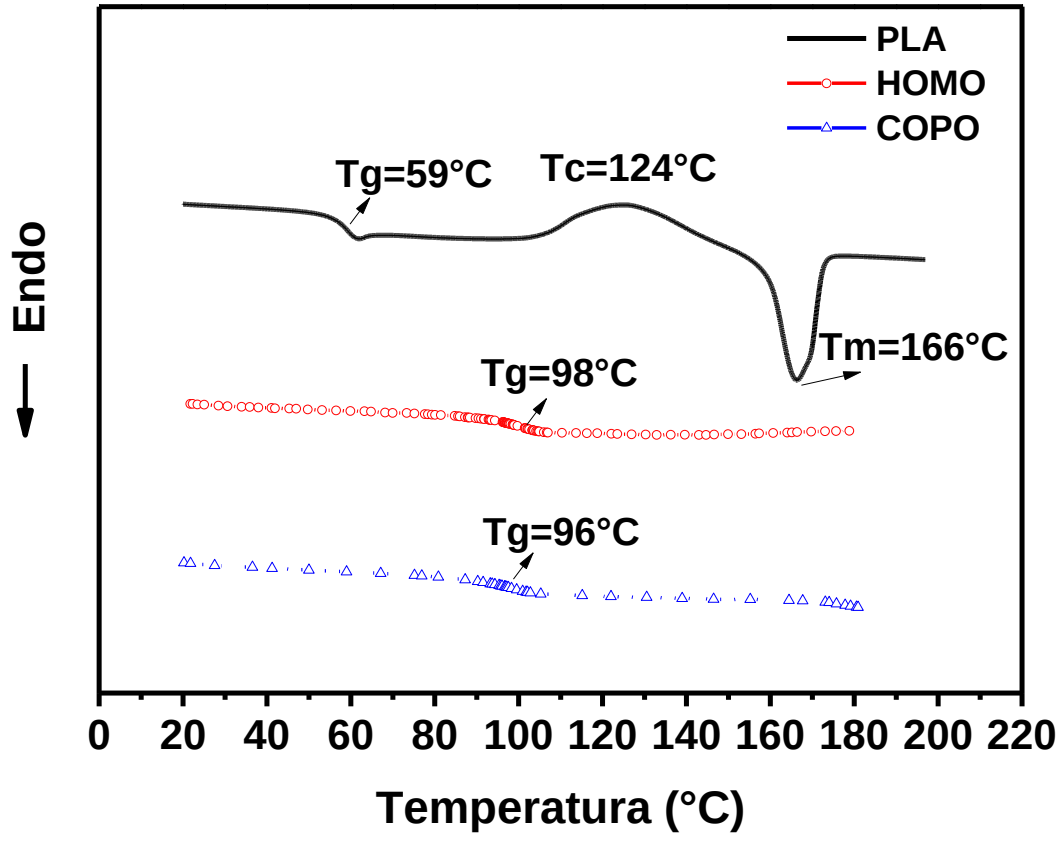
Compatibilización reactiva de mezclas de PLA/ATP

Materiales

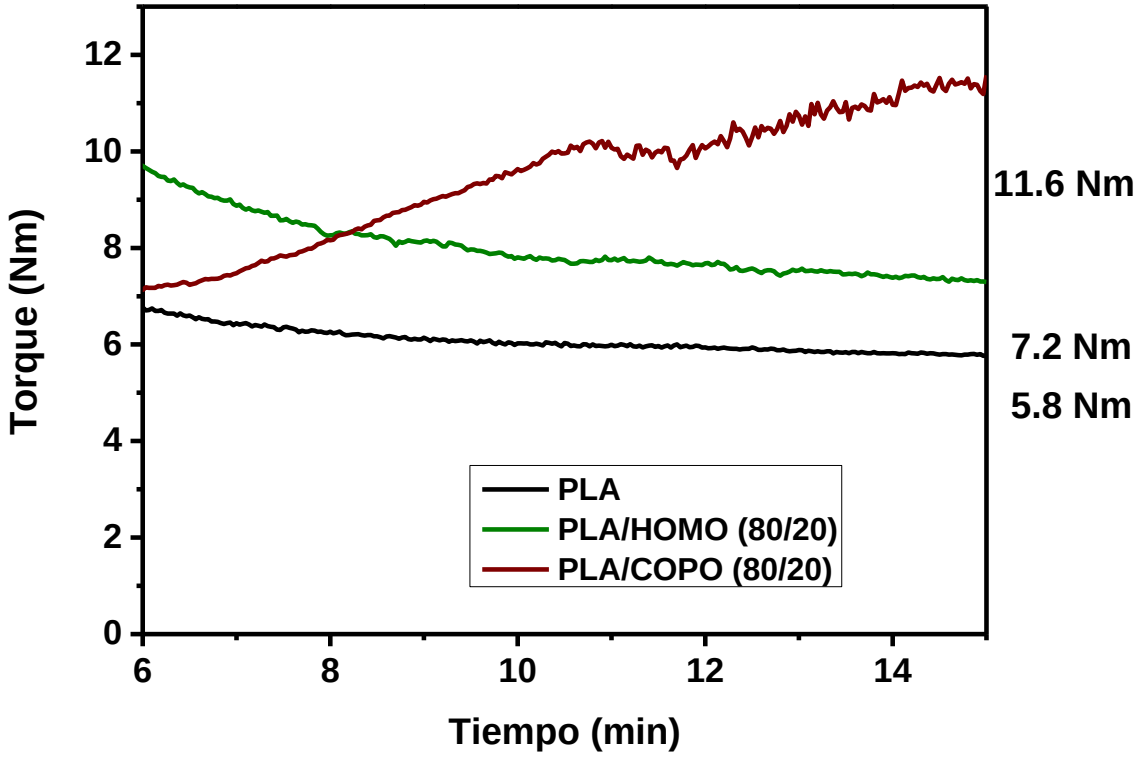
- Ácido poliláctico (PLA) 2002D de Nature Works
- Almidón Termoplástico (ATP), obtenido por extrusión con 3 diferentes contenidos de glicerina (ATP29, ATP36 y ATP40)
- Copolímero acrílicos

COPOLIMERO	Mn (Da)	%GMA (peso)
Homopolímero (HOMO)	56547	0
Copolímero (COPO)	55610	4.7

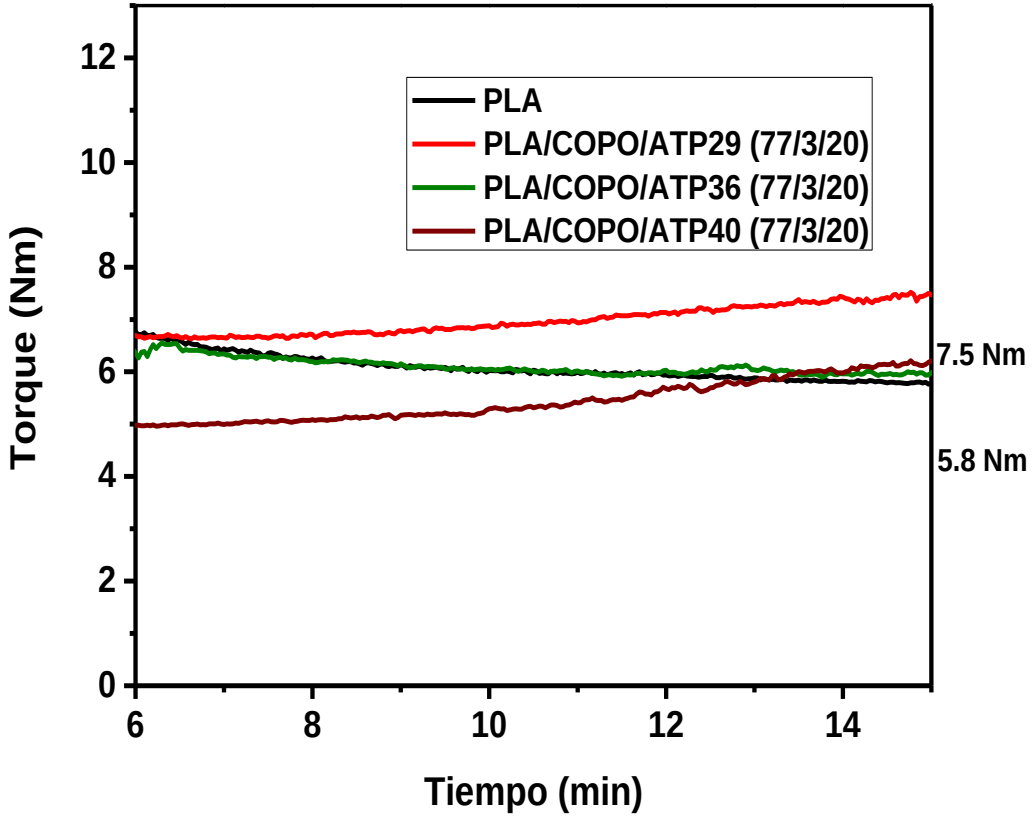
Termograma de DSC de las mezclas preparadas por casting del PLA, Homopolímero y del Copolímero



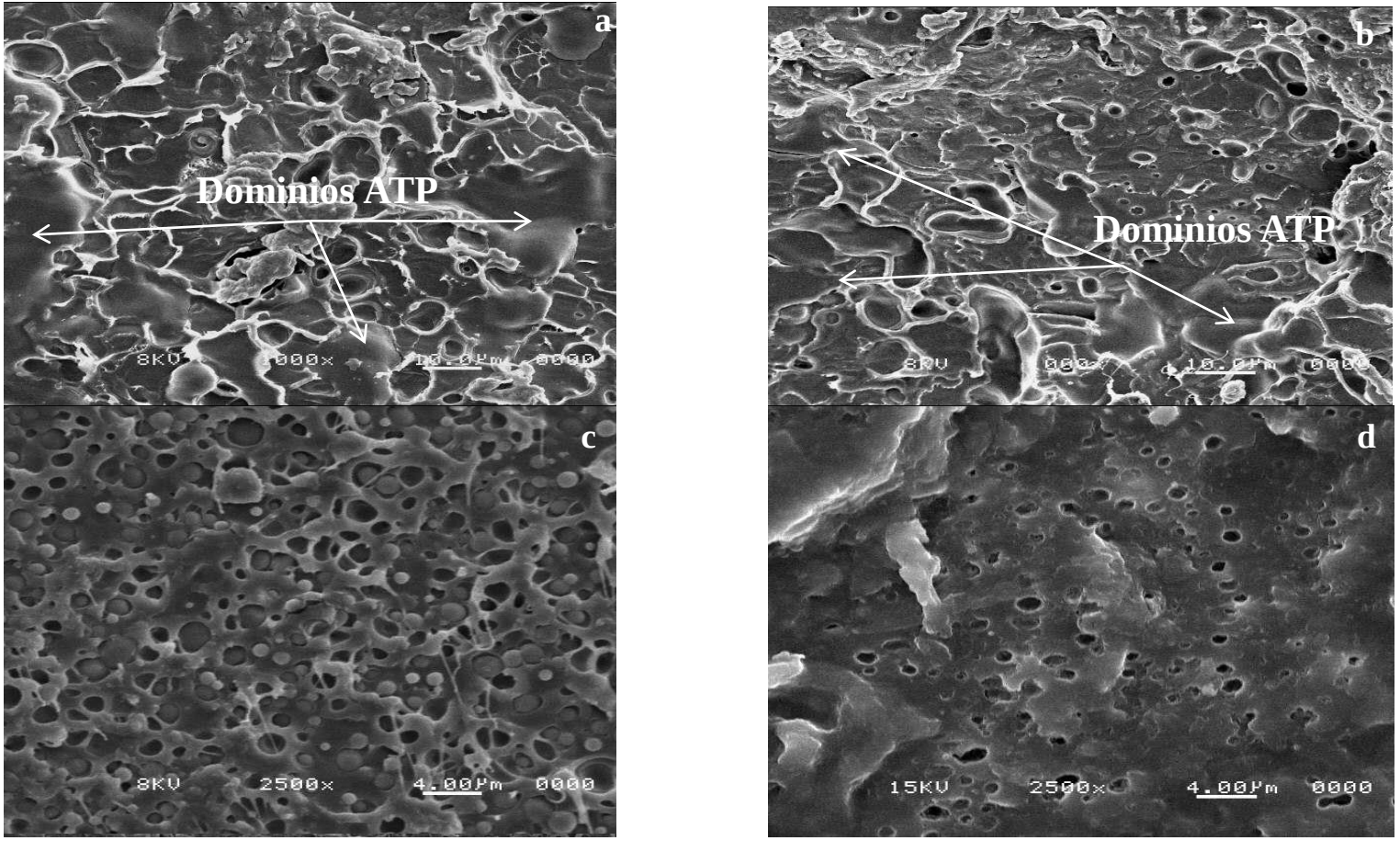
Reometría de torque de las mezclas de PLA/Homopolímero y del PLA/COPO (80/20)



Reometría de torque en función del contenido de glicerina en el ATP

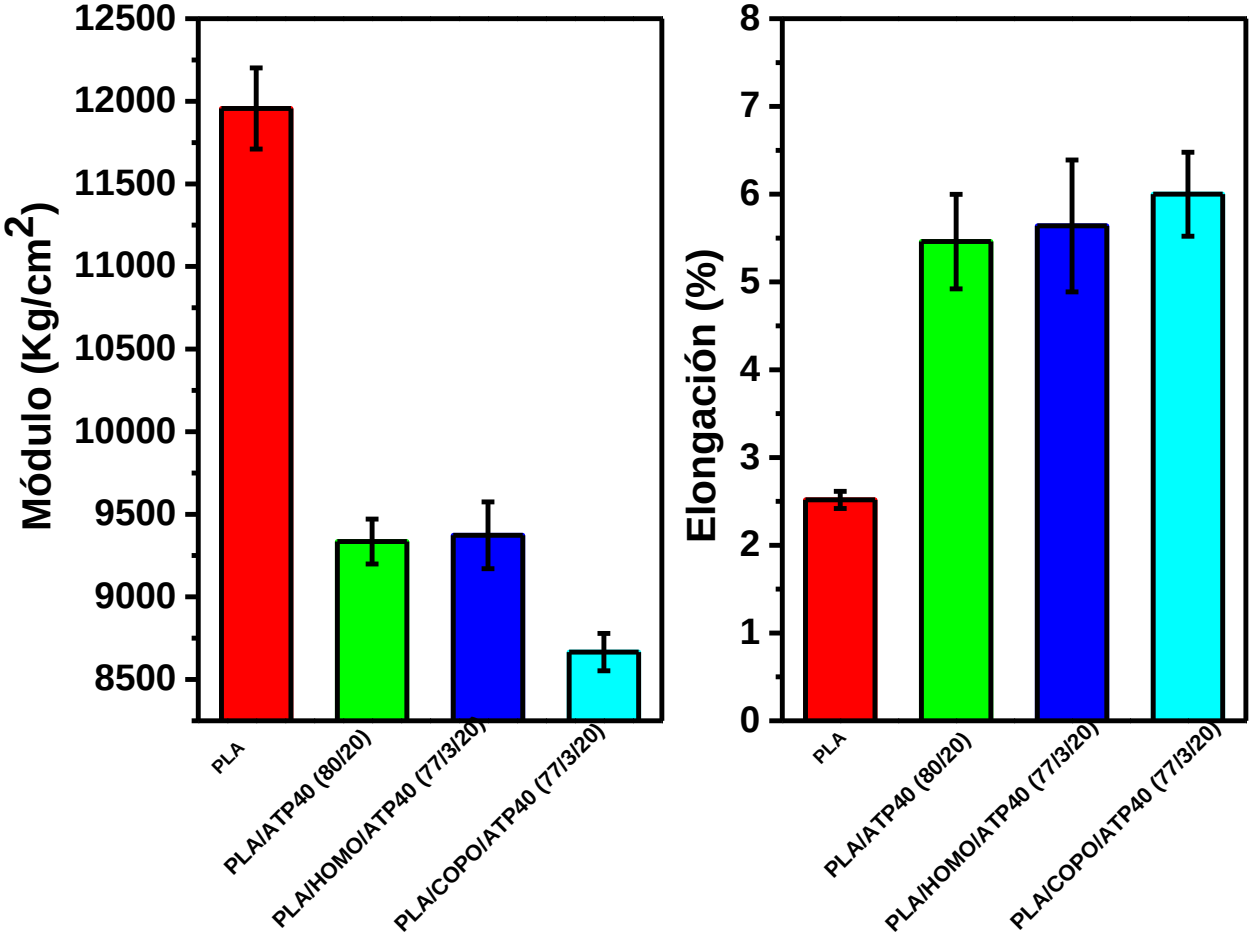


Efecto del copolímero acrílico y de la glicerina

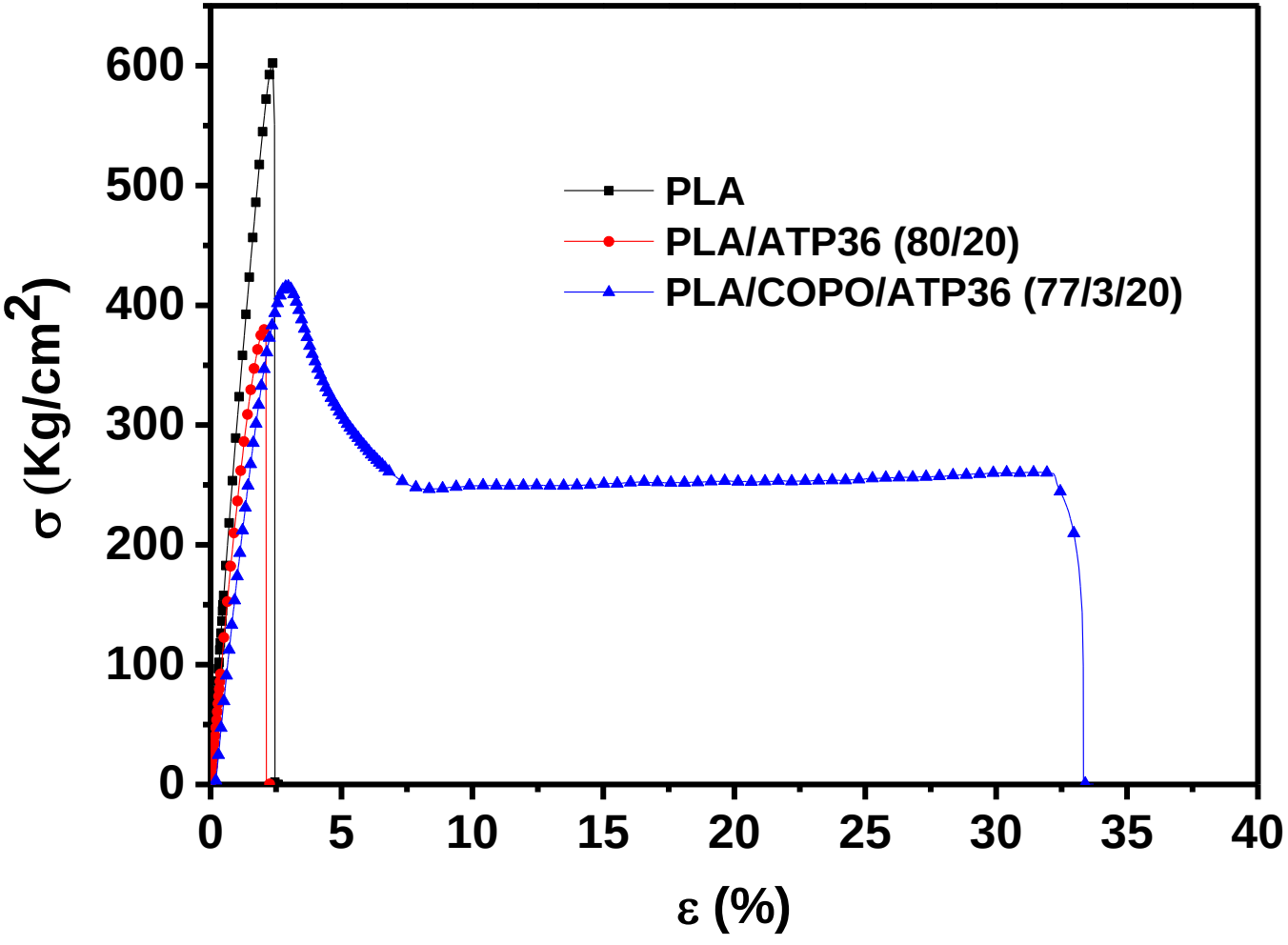


a) PLA/ATP36, b) PLA/ATP40 (80/20), c) PLA/COPO/ATP36 y d) PLA/COPO/ATP40 (77/3/20)

Propiedades mecánicas a tensión



Propiedades mecánicas a tensión



Conclusiones

- En este trabajo se pudieron obtener mezclas de PLA/ATP compatibilizadas exitósamente con un copolímero de MMA-GMA.

- La morfología y las propiedades mecánicas de las mezclas compatibilizadas demuestran que el agente compatibilizante generado **in-situ** cumple con dos de sus funciones: Disminuir la tensión y adhesión interfacial de los componentes de las mezclas.

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