

Processing Guide

Replacing standard PLA with PLA homopolymers

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 Page 1 of 1
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PROCESSING GUIDE

REPLACING STANDARD PLA WITH PLA HOMOPOLYMERS

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INTRODUCTION

In many application areas where standard PLA (e.g. LX175) is used today, a PLA homopolymer substitute (e.g. L175) could result in improved properties of the final product, such as a slightly higher heat resistance. When doing so, special attention should be paid to the recommended processing conditions, as the melting temperature and hence the recommended processing conditions of various PLA grades can differ.

Thermal properties, such as the melting point (T_m) and the glass transition temperature (T_g) of PLA are determined by the stereochemical purity of the PLA. PLA homopolymers produced from stereochemically pure lactides have a T_m of $\sim 175^\circ\text{C}$ and a T_g of $\sim 60^\circ\text{C}$. Increasing the level of meso- or D-lactide in PLA will result in a decrease of the T_m and T_g .

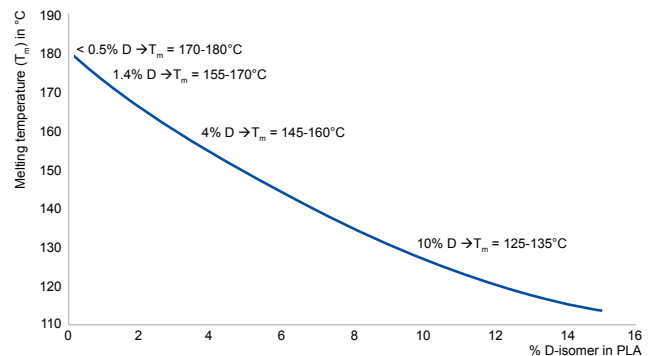


Figure 1: Dependence of T_m on the %D-isomer of the PLA polymer (adapted from R. Auras et al. 2011; ISBN 978-0-470-29366-9).

PROCESSING OF PLA HOMOPOLYMERS COMPARED TO STANDARD PLA

When used in injection molding, sheet film extrusion, blown film or as part of a compound, PLA should be processed above its melting point. Furthermore, when processing compounds in which PLA is the minority component, the recommended processing temperatures are above the melting point of the PLA polymer. Table 1 shows the recommended processing temperature range for the Luminy® PLA grades. Long residence times at processing temperatures above 220°C could result in material degradation and loss of properties in the final product.

PLA category	Luminy® PLA grade	T_m (°C)	$T_{\text{processing}}$ (°C)
High heat PLA	L105	175	190-210
	L130	175	190-210
	L175	175	190-210
	LX575	165	190-210
	LX530	165	190-210
	D120	175	190-210
Standard PLA	D070	175	190-210
	LX175	155	170-210

Table 1: Recommended processing temperatures for Luminy® PLA.

REPLACING STANDARD PLA WITH PLA HOMOPOLYMERS IN TRANSPARENT APPLICATIONS

PLA homopolymers crystallize faster compared to standard PLA. Precautionary processing actions (heating profiles, cooling profiles, etc) should be taken to ensure processing stability and transparency of the final article. For thermoforming, a shorter and steeper heating profile during sheet heating should be applied, as well as a cooled mold for the forming step, to prevent crystallization. Should you have any questions on how to replace standard PLA with PLA homopolymers, please contact us at pla@total-corbion.com.

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