

Supplementary materials

Study of Melamine-Formaldehyde/Phase Change Material Microcapsules for the Preparation of Polymer Films by Extrusion

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Abstract: n-Eicosane-melamine formaldehyde microcapsules of an average size of 1.1 μm and latent heat of fusion of 146.2 ± 5.3 J/g have been prepared. They have been characterized by scanning electron microscopy, FTIR spectroscopy, calorimetric techniques, and thermogravimetric analyses. Under processing conditions, the microcapsules apparently preserved their properties, also maintaining their n-eicosane loading and heat storage capacity under washing conditions (water with detergent at 60 $^{\circ}\text{C}$). The microcapsules synthesis has been scaled up for the fabrication of functional films by extrusion. For that, polymer films containing 10 wt.% of microcapsules were prepared at a pilot plant level. In those films, even though a fraction of the n-eicosane loading was lost during the extrusion process, the microcapsules showed good compatibility within the polyamide. The percentage of PCM in the polyamide 6 films was estimated by TGA, verifying also the heat storage capacity predicted by DSC (2.6 ± 0.7 J/g).

Keywords: n-Eicosane-melamine formaldehyde microcapsules; polyamide 6 films; phase change material; Heat storage

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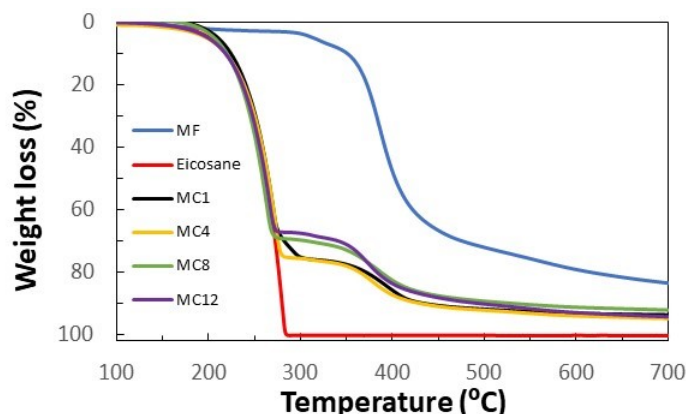


Figure S1. TGA of the MF/n-eicosane MCs synthesized during the scaling process.

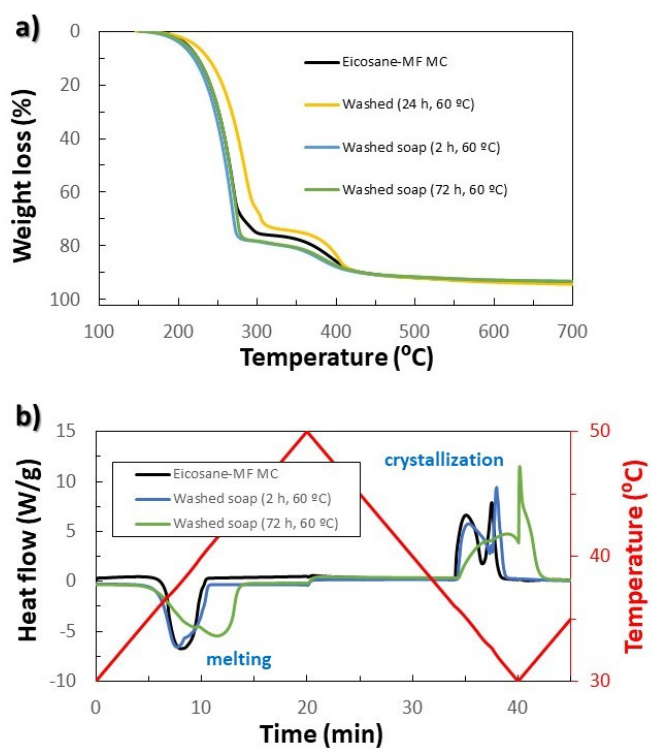


Figure S2. Microcapsules MC1 washed in different conditions: (a) TGA; (b) DSC.

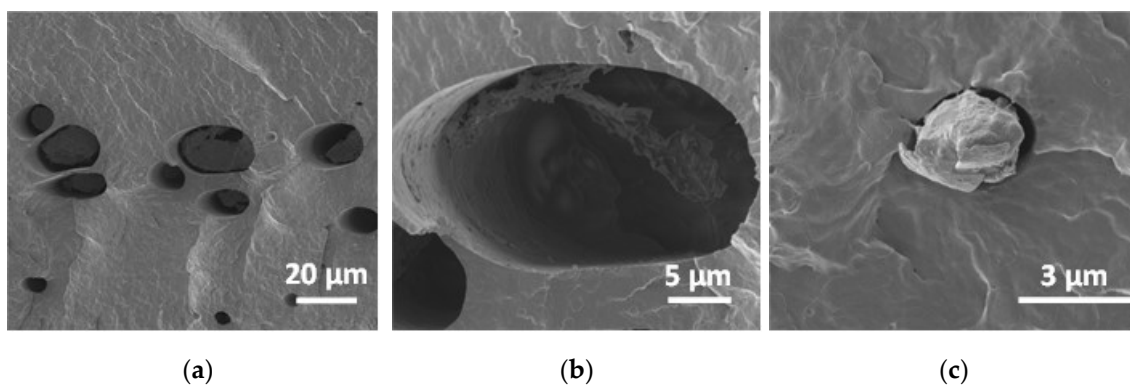


Figure S3. Cross-section view of PA6 film made at 235 °C and 90 bar with 17 wt.% MF/n-eicosane MCs.

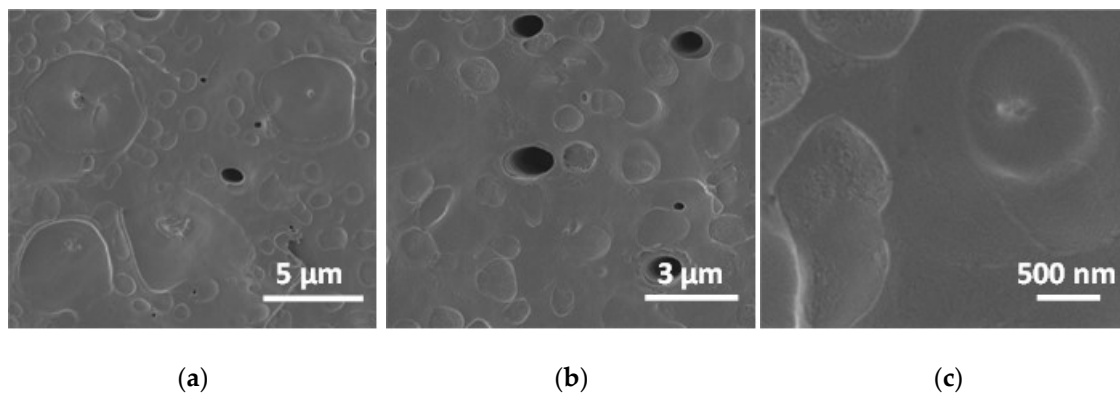


Figure S4. Cross-section view of PA6 film made at 235 °C and 90 bar with 9 wt.% MF/n-eicosane MCs.

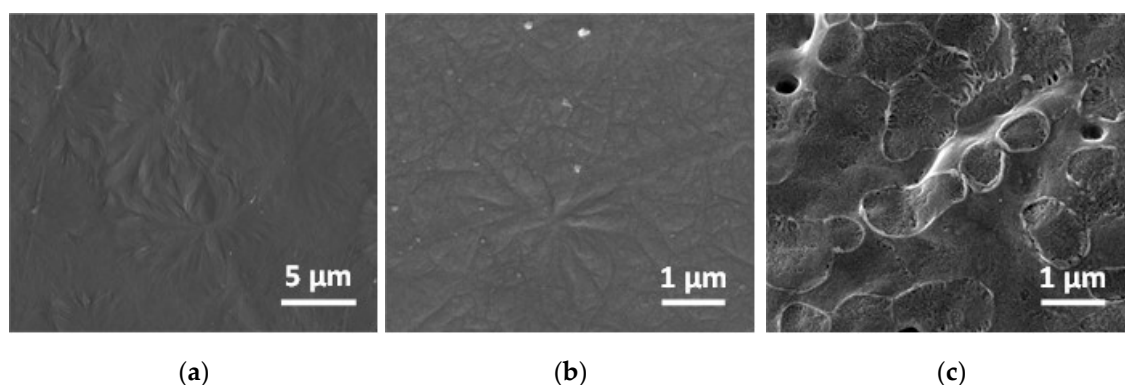


Figure S5. PA6 film made at 256 °C and 50 bar: (a) surface view without MCs; (b) surface view with 10 wt.% eicosane-MF MCs and (c) cross section view with 10 wt.% MF/n-eicosane MCs.

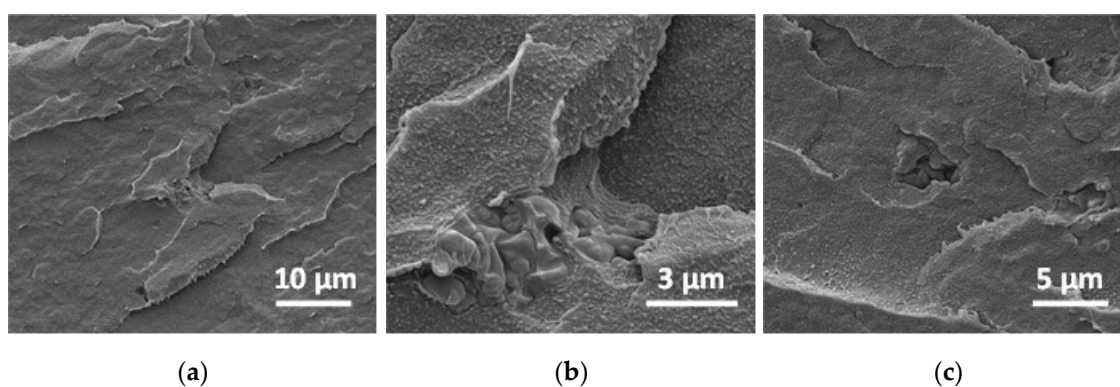


Figure S6. Cross-section view of low density polyethylene film made at 133 °C and 181 bar with 10 wt.% MF/n-eicosane MCs.