

TOWARDS THE PRODUCTION OF HIGHLY TRANSPARENT THICK FILMS FROM NANOCELLULAR POLYMERS.

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Nanocellular polymers have attracted significant attention in the last years due to their attractive properties that they have been already proven to present in comparison to microcellular polymers^{1,2}. So it is common to talk about their improved thermal insulation properties due to Knudsen effect^{3,4} or their improved mechanical properties^{5,6}, among others.

However, one of the most promising properties recently proved is their ability to become transparent when reducing the cell size below 50 nm⁷. This property allows to produce materials with a combination of characteristics never showed before for hundreds of potential applications, the most promising one is the production of insulating transparent windows, either for the building or the automotive sector.

Previous works studying this aspect of nanocellular materials have aroused to very promising results, so materials with a transparency of 90% have been produced by means of nanocellular PMMA⁸. However, those materials present some drawbacks. Firstly, this high transmittance is reached for a 0.05 mm in thickness sample, while when increasing the thickness up to 1 mm, transparency is decreased up to 40%. Secondly, the production of such films is not straight forward; large processing times (around 15 days), as well as a post-processing of the samples is needed to obtain the final transparent film from the initial precursor (of 4 mm).

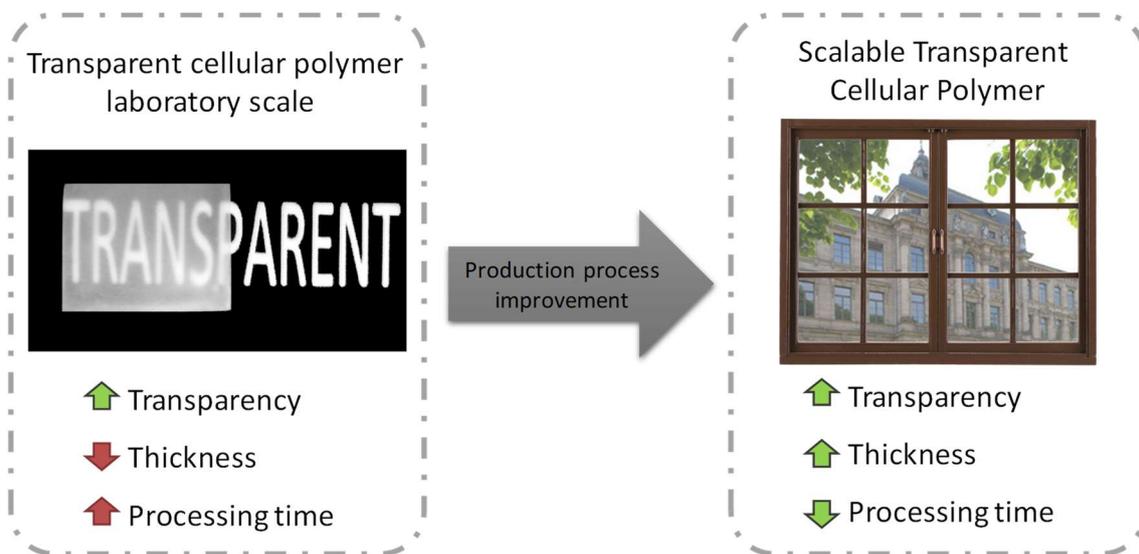


Figure 1. Scheme of the improvements in the production of transparent cellular polymers.

In this work, an improvement of the production process is presented, being now possible to produce highly transparent films in affordable times, and within any post-processing. On the one hand, a new range of production parameters has been tested, substituting the low temperatures needed for the production of transparent polymers by high pressures. This leads to the reduction of processing times from days to hours. Additionally, cellular structures with innovative characteristics have been produced. On the other hand, the improvement in the precursor's production leads to no need for post-processing, and thick high transparent films of 1mm are directly obtained immediately after the foaming process.

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