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Published in:
Book of Abstracts, Sustain 2017

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

The future of the packaging industry: Roll-to-roll production of lotus leaves and rose petals

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Nowadays most of the consumer products are packed into individual plastic bags and wrapped into plastic foils. Plastic packaging serves primarily as barriers for sunlight, oxygen, water, etc., which prolongs the shelf life of the food and pharmaceutical compounds, and therefore is not always possible to avoid. However it is possible to recycle polymers, with one important note: the packaging needs to be clean and freed of the food residues before it can be recycled. By wasting water and chemicals on cleaning the used plastic foils/bottles/containers, the whole recycling process becomes unsustainable.

The food residue problem can be avoided if the packaging foil does not stick to the packed product. Conventional packaging foils are produced using a roll-to-roll process and it is most convenient to structure the surface of the polymer while producing the foil. In this study hydrophobic structures (mimicking lotus flower and rose petal) are produced at a high speed roll-to-roll process. The replication fidelity is estimated and hydrophobicity of the different surface structures is characterized.

This high-speed and low cost method looks very promising[1,2], however further material, structure and droplet analysis should be carried out in order to achieve omniphobicity.

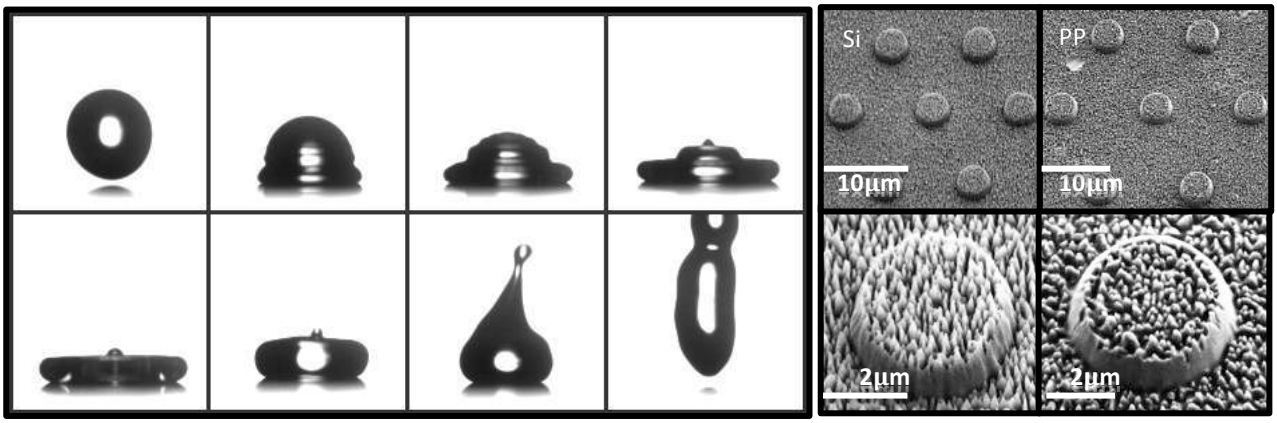

Figure 1. To the left: a water droplet landing on the packaging foil structured with hydrophobic structures. To the right: The original Si structure and the same structure replicated in PP. The PP surface is covered with 10nm Au, hence the sharp needle-like structures appear rounded-off at the top, even though the structures in PP are replicated 100%.

[1] A. Telecka, S. Murthy, L. Schneider, H. Pranov, Taboryski, ACS Macro Lett. 5 (2016) 1034−1038.
[2] N. Okulova, P. Johansen, L. Christensen, R. Taboryski, MEE 176 (2017) 54-57.