R2R fabrication of plasmonic color surfaces

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In a recent publication, we reported on the road map towards upscaling of plasmonic color printing (Figure 1).[1] This was done by using a high-speed (10 m/min) roll-to-roll (R2R) extrusion coating method (see Figure 2)[2] and subsequent R2R Al metallization. The metal layer comprised nanoscale gaps and weak links in a continuous topology, whereas, the structure defining the plasmonic resonances comprised a polypropylene (PP) layer having 100 nm deep pits of varying sub-wavelength diameter and pitch length. This metasurface design was originated in Si by electron beam lithography, and allowed for a high tolerance of the Al thickness to make it compatible with industrial scale fabrication.

Here we will discuss potential applications of this technology.

[1] Murthy et al. 2017, “Plasmonic color metasurfaces fabricated by a high speed roll-to-roll method” Nanoscale **9**, 14280-14287
[2] Murthy et al. 2016, “Fabrication of Nanostructures by Roll-to-Roll Extrusion Coating,” Adv. Eng. Mat. **18**, 484-489

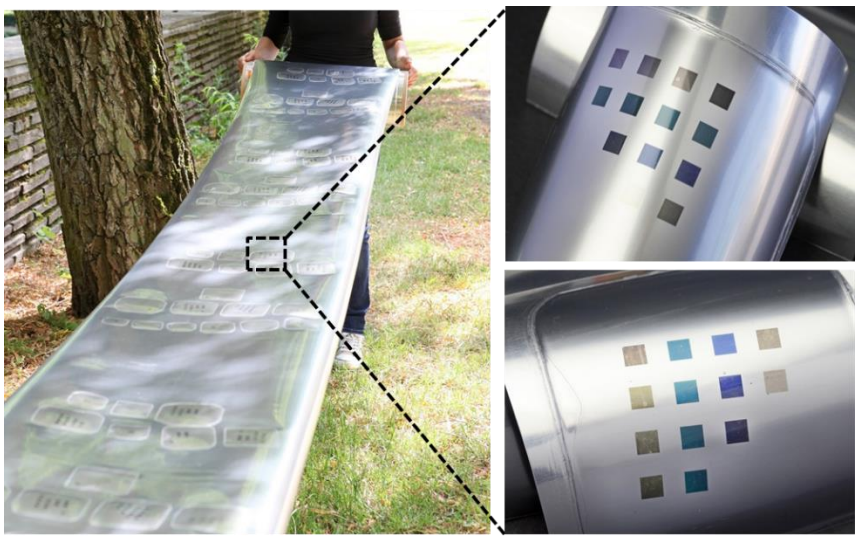

Figure 1: Plasmonic color foil, comprising a R2R nanostructured PP made by extrusion coating, a R2R aluminum coating, and protective lacquer coating.

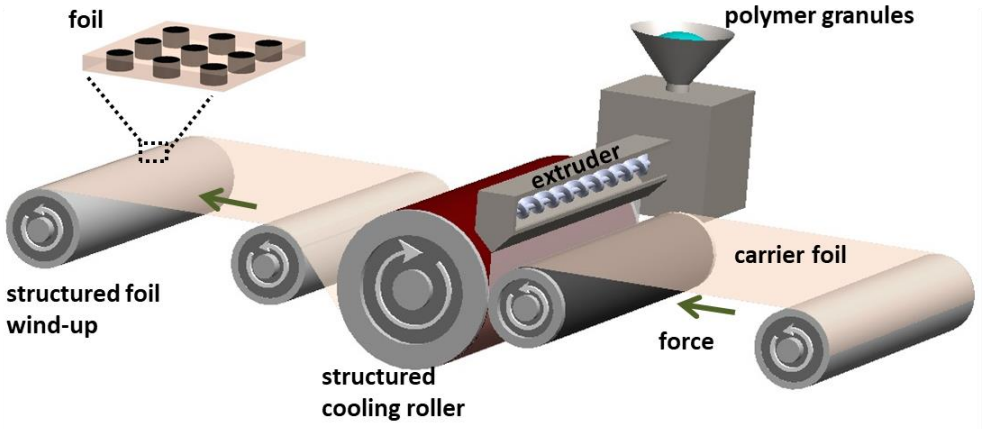

Figure 2: Schematic of the extrusion coating process for production of nanostructured polymer foils: The polymer melt curtain is extruded through a flat die, susequently laminated onto a carrier foil by squeezing the melt between a nano-structured cooling roller kept below the solidification temperature of the polymer and a flexible counter roller. Finally, the structured foil is wound up on a winding roller.