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Cracking the chocolate egg problem: polymeric films coated on curved substrates PIERRE-THOMAS BRUN, ANNA LEE, JOEL MARTHELOT, Massachusetts Institute of Technology, GIOELE BALESTRA, FRANOIS GALLAIRE, EPFL, PEDRO REIS, Massachusetts Institute of Technology — Inspired by the traditional chocolate egg recipe, we show that pouring a polymeric solution onto spherical molds yields a simple and robust path of fabrication of thin elastic curved shells. The drainage dynamics naturally leads to uniform coatings frozen in time as the polymer cures, which are subsequently peeled off their mold. We show how the polymer curing affects the drainage dynamics and eventually selects the shell thickness and sets its uniformity. To this end, we perform coating experiments using silicon based elastomers, Vinylpolysiloxane (VPS) and Polydimethylsiloxane (PDMS). These results are rationalized combining numerical simulations of the lubrication flow field to a theoretical model of the dynamics yielding an analytical prediction of the formed shell characteristics. In particular, the robustness of the coating technique and its flexibility, two critical features for providing a generic framework for future studies, are shown to be an inherent consequence of the flow field (memory loss). The shell structure is both independent of initial conditions and tailorable by changing a single experimental parameter.

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