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Session: Ingredients

Single and multiple dip coating using liquids with a yield-stress

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Dip coating is a widely used process in food manufacturing. Controlling the thickness of the coating (e.g. chocolate) is key to deliver the desired sensorial properties and to be compliant with the product's nutritional claims. Whilst dip coating with Newtonian liquids is physically well understood, coating food products almost invariably involve liquids with more complex rheology. This makes the process more difficult to design and control and reduces the coating homogeneity. Here, we focused on the coating of a flat surface using a liquid following a Hershel-Bulkley rheological model, without measurable thixotropy. The liquid yield stress and the withdrawal speed from the bath were varied. The impact on the average coating thickness, uniformity and variability is discussed. Repeated dipping was also performed to highlight the effect on the coating thickness, the reduction in thickness variability, and an increased homogeneity. The results are interpreted using three relevant dimensionless numbers (Bingham, Capillary and G = ro*g*h / Tau_c) and are put in the context of the existing theories for dip coating with Newtonian liquids and of the previous studies involving liquids with more complex rheology. This study paves the way toward an integrated design of the coating process and the liquid rheology of foods, such as chocolate, and toward more robust dip coating processes for food products.