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A 'Coating' Operating-Window for a Metal-Casting Flow CORMAC J. BYRNE, PAUL H. STEEN, School of Chemical and Biomolecular Engineering, Cornell University, STEVEN J. WEINSTEIN, Eastman Kodak Company — Planar-flow single roll melt spinning is a promising technology for the next generation of continuous casting machines. In the process, a planar nozzle is held close to a rotating metal wheel and liquid metal is forced through the nozzle into the gap region between the nozzle and wheel where a puddle, constrained by surface tension, is formed. A solidification front grows along the wheel as it translates, forming a solid ribbon ($\sim$100 μm thick) which is continually ejected from the puddle ($\sim$ 10 m/s). An operating window can be predicted based on the possible curvatures of the upstream meniscus, similar to the approach taken for some liquid film coating flows. While the derivation of the window mirrors that of the coating-flow literature, the flow regimes are different. Apart from the presence of solidification, the pressure losses in casting flows are predominantly inertia dominated, while viscous effects are usually dominant in coating flows. A range of accessible product thicknesses can be predicted when casting open to atmosphere. This predicted thickness range is compared with well-established empirical windows. The predicted window also indicates considerable benefits (extended operability) from applying a pressure difference between the upstream and downstream menisci, as will be discussed.

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