A microfluidic channel for understanding two-layer slot coating flows

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Two-layer slot coating is an efficient method to produce functional films in that it saves energy required for the post-processing of the coated layer. Among many transport phenomena, the separation of the interlayer in the downstream coating gap is the most important factor that needs to be carefully investigated to find a way to produce the high quality of the end product. Different mechanisms such as mid-lip vortex and diffusion can cause the mixing of the two-layer that ultimately lead to coating defects. It is thus crucial to understand under which operating conditions these mechanisms take place.
In this study, we used a microfluidic y-channel fabricated using polydimethylsiloxane (PDMS) to mimic flows inside the downstream coating gap of two-layer slot die and to observe the mass transport occurring across the interlayer boundary. The geometry of the channel was based on a typical design of the two-layer slot coating system. The same system was analyzed both numerically and analytically. The results were compared with the experimental data.