Drying of channels by evaporation through a permeable medium

We study the drying of isolated channels initially filled with water moulded in a water-permeable polymer (polydimethylsiloxane, PDMS) by pervaporation, when placed in a dry atmosphere. Channel drying is monitored by tracking a meniscus, separating water from air, advancing within the channels. The role of two geometrical parameters, the channel width and the PDMS thickness, is investigated experimentally. All data show that drying displays a truncated exponential dynamics. A fully predictive analytical model, in excellent agreement with the data, is proposed to explain such a dynamics, by solving water diffusion both in the PDMS layer and in the gas inside the channel. This drying process is crucial in geological or biological systems, such as rock disintegration or the drying of plant leaves after cavitation and embolism formation.