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Convective drying of a macroporous medium: a comparison of original porous asphalt geometry with randomized Kelvin cells¹ SREEYUTH LAL, ETH - Zurich, FRANCESCO LUCCI, THIJS DEFRAEYE, LILY POULIKAKOS, MANFRED PARTL, DOMINIQUE DEROME, EMPA, JAN CARMELIET, ETH - Zurich — Forced convective drying of a macroporous medium is a complex interplay of enhanced air-vapor mixing due to turbulent airflow at the air-solid interface and the momentum transfer resulting from air infiltration into the material. Such air infiltration is expected to have a non-trivial effect on the drying rate of a material like porous asphalt (PA), which is characterized by large, interconnected pores open to the surface. Through a series of CFD simulations performed on an original PA geometry extracted from CT scans, we quantify the relative impacts of interior material resistance and boundary layer resistance on moisture transport in PA. At wind speeds below 1 m/s, the effect of material resistance on the total moisture transfer is found to be high due to low air infiltration. At higher wind speeds, air infiltration increases by which the material resistance decreases. Similar simulations are performed on an idealized PA geometry made from randomized Kelvin cells (KC) since they are computationally less expensive, and thus ideal for parametric studies. However, in KC cells, drying from air infiltration is stronger than diffusive drying even at low wind speeds. This shows the need to fine-tune the pore connectivity of KC to better match the air infiltration observed in PA.

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