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Pseudo-Steady Liquid Transport in Aqueous Foams during Filling of a Container MICHAEL CONROY[1], RAMAGOPAL ANANTH[2], Naval Research Laboratory — Various applications of aqueous foams involve filling a container or a column (e.g., fractionation), where the foam is formed and processed. However, existing studies in the literature do not treat the filling stage and only describe liquid transport within a static foam bed. We developed a theory that predicts liquid loss from the foam and the liquid distribution within its interior during the filling and post-filling stages. During the filling stage, the theory predicts that the foam reaches a pseudo-steady state characterized by a time-independent drainage rate and liquid fraction. The pseudo-steady-state liquid fraction appears above a thin, liquid-saturated boundary layer that exists at the bottom of the foam bed. During the post-filling stage, the theory predicts that the drainage rate decreases with time, similar to static foams beds studied by others. The theory compares well with our previously reported volume-averaged macroscopic model and drainage measurements for dry (high-expansion) foams. We will show that drainage during the filling stage is significant when the fill time is comparable to the intrinsic drainage time scale of the foam.

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