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Development of a velocity and concentration measurement method for CO_2 dissolution in brine within a Hele-Shaw cell MENGYE ZHAO, KENNETH KIGER, University of Maryland, ANKUR KISLAYA, JERRY WESTERWEEL, Delft University of Technology — We perform quantitative velocity and concentration measurement within a Hele-Shaw cell Rayleigh-Benard convection as CO_2 dissolves into brine. The velocity is measured using PIV under large depth-of-field and gap-wise Poiseuille flow conditions, making reliable quantitative velocity measurement difficult due to the large velocity gradient across the gap. Previously, particle sorting has been purposed and validated as a means to resolve this problem. The method flushes particles along the cell until all have migrated to their gap-wise equilibrium plane, thus providing an unambiguous velocity magnitude. However, in order to accomplish the sorting, a large portion of the test cell will not be usable for measurement. We purpose a new method to overcome this limitation. We first conduct PIV without sorting particles to obtain only the velocity direction. This provides the value of the in-plane velocity ratio (u/v) at every x, y coordinate pair. We then obtain the CO_2 concentration map using fluorescent emission of a Ph sensitive dye. Having mapped the concertation, we combine the u/v information and solve the CO_2 advection-diffusion equation to get the value of u and v. We demonstrate this method by comparing its result with that from the particle sorting method.

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