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Mixing of a passive scalar in a turbulent bubbly flow ELISE ALMRAS, VARGHESE MATHAI, DETLEF LOHSE, Physics of Fluids, University of Twente, CHAO SUN, Center for Combustion Energy Department of Thermal Engineering, Tsinghua University — In this work, we investigate the mixing of a passive scalar at high Schmidt number by a homogenous bubble swarm in the presence of external turbulence. The experiments are conducted in the Twente Water Tunnel, in which nearly homogeneous and isotropic turbulence is produced using an active grid. The level of the external turbulence is varied for Taylor-Reynolds number ranging from 180 to 360 and the global gas volume fraction is varied from 0 to 3%. We continuously inject a passive fluorescent dye at a fixed position, and measure the horizontal concentration profile of the dye at different heights by recording the fluorescence levels and applying an image processing. A horizontal effective diffusivity is then calculated from the spatial evolution of the variance of the horizontal concentration profile. The diffusion coefficient is found to increase with the strength of the external turbulence and the gas volume fraction, indicating an enhancement of mixing. Finally, we connect the effective diffusion coefficient to the hydrodynamic properties of the flow in order to have a better understanding on the underlying mixing mechanisms.

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