83b Formation and Size Distribution of CO2 Drops in Static Mixer for Ocean Disposal

Hideo Tajima, Akihiro Yamasaki, and Fumio Kiyono

Formation and distribution of CO2 drops in water in a Kenics-type static mixer for the CO2 ocean disposal was investigated experimentally under the pressure and temperature simulating the ocean condition at 700 m below the ocean surface. Liquid CO2 is covered with thin CO2 hydrate under this condition. Because the wall of the static mixer was transparent, the formation process and variation in the size distribution of the CO2 drops covered with hydrate in the mixer could be investigated visually. It was found that the liquid CO2 entered the mixer underwent a continuous process of breakup and redistribution in the mixer, and at the release, the initially large, irregular drops formed in a premixing unit became small, spherical drops, and fully dispersed in water; and that the sizes of the CO2 drops and their distribution in water changed only dramatically in the first several mixing elements, beyond which the drop sizes varied only limitedly and could be well characterized by the Gaussian-like distribution with respect to the Sauter mean diameter (SMD). The SMD for the CO2 drops having thin hydrate film formed in the static mixer was found to be governed primarily by the velocity of the continuous phase and the number of mixing elements in the mixer. A correlation was obtained for the dependence of the non-dimensional SMD on the Weber number on the basis of the continuous phase and the residence time for the CO2 drops in the mixer, which would be useful in an optimum design of the static mixer for the CO2 ocean disposal.