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Bubble interfacial area in a swirling contactor: Experiments and CFD simulations

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Abstract

The bubble size, gas holdup, and interfacial area in a swirling contactor were investigated through experiments and simulations. The interfacial area was obtained for liquids and gases with Reynolds numbers Re_l and Re_g, respectively. The contactor was divided into 12 subregions. When Re_g=23.8 and Re_l =20075.4, regions near the side wall and center of the swirl contactor exhibited small bubbles with diameters of 0.33–0.40 and 0.38–0.45 mm, respectively. Re_l was negatively related to bubble size, gas holdup, and interfacial area, whereas Re_g was positively related. The maximum bubble interfacial area among the 12 subregions was 530 m^{-1},and for the entire swirling contactor was 196.3 m^{-1} with a gas–liquid ratio of 0.022. Euler-Euler simulations using the population balance model accurately predicted this area. Larger areas were obtained at lower Re_l values. Increasing the liquid velocity is not necessary to achieve larger areas, which indicates a contactor with lower energy consumption.

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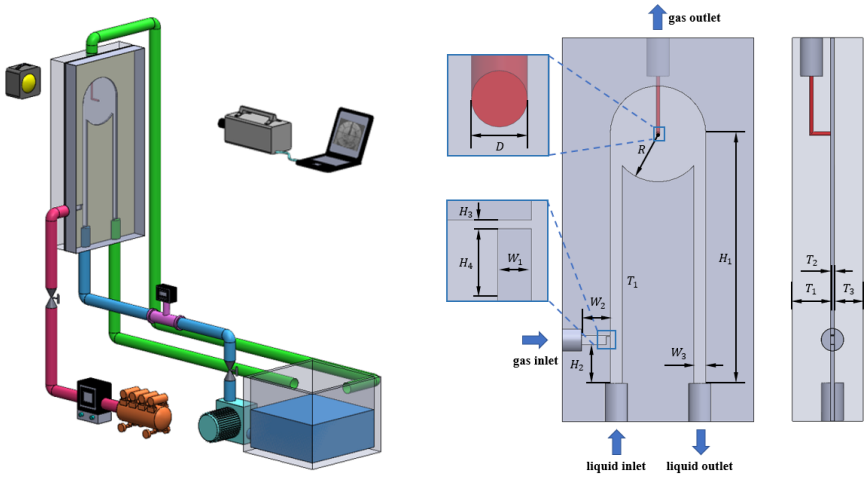

(A) (B)

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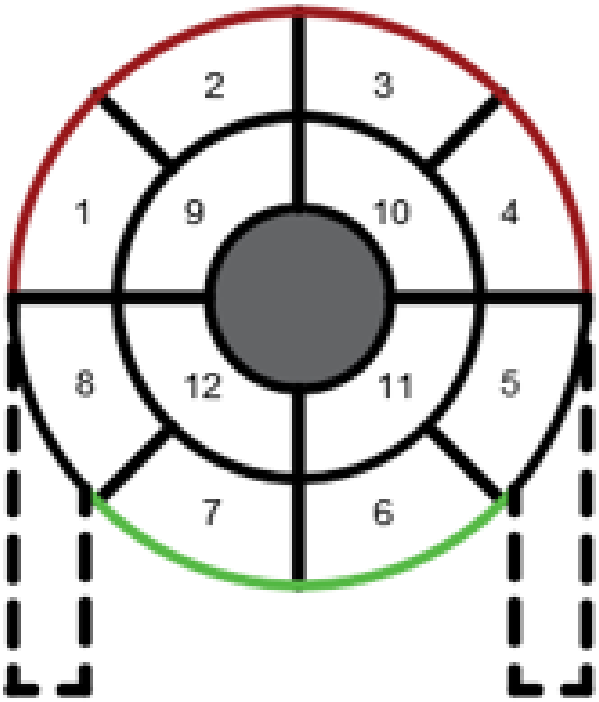

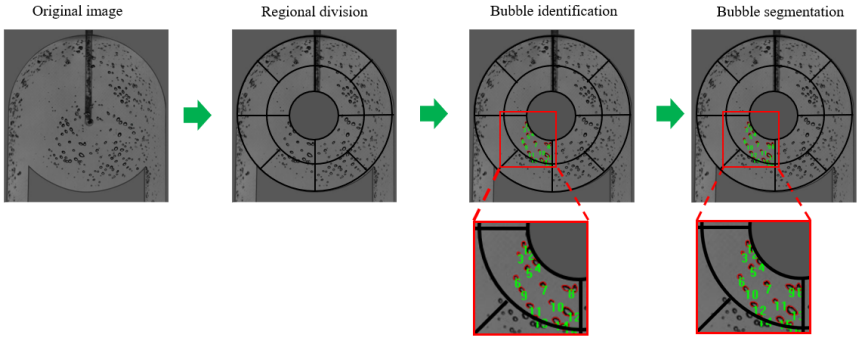

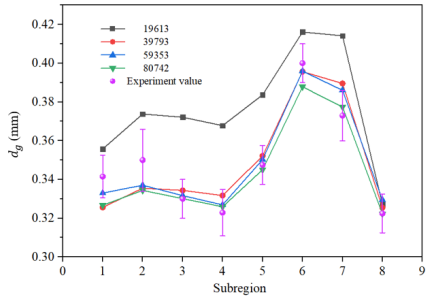

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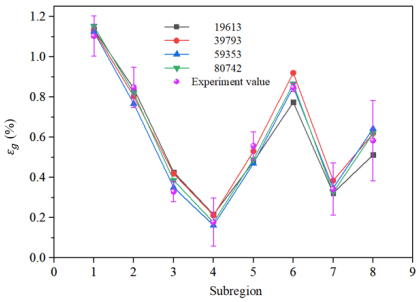

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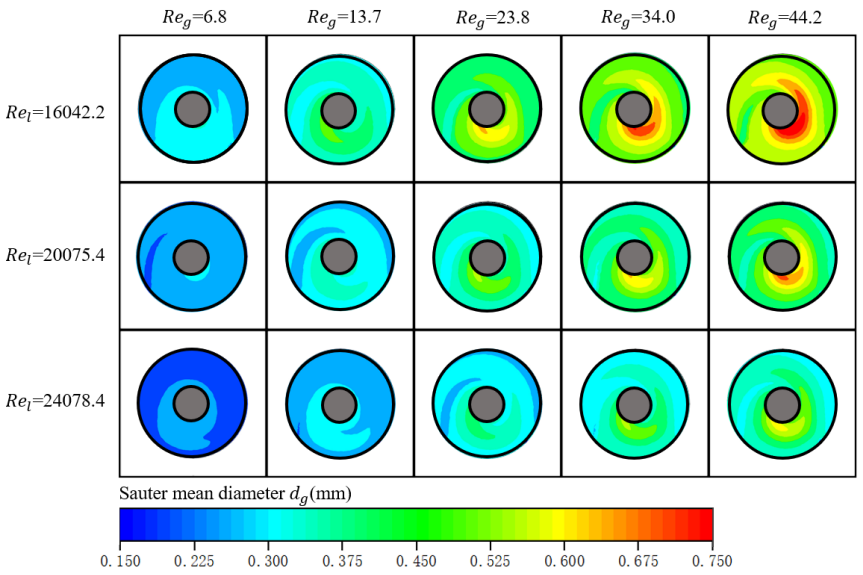

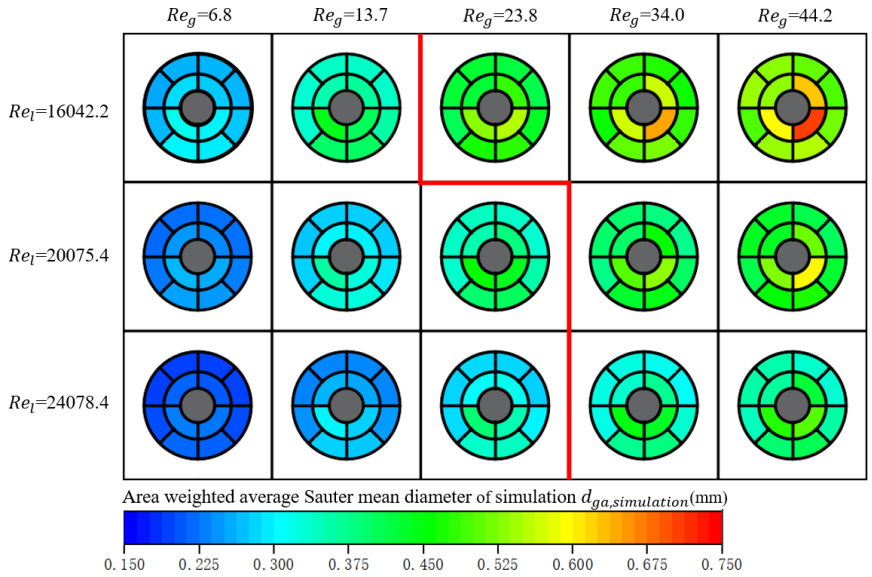

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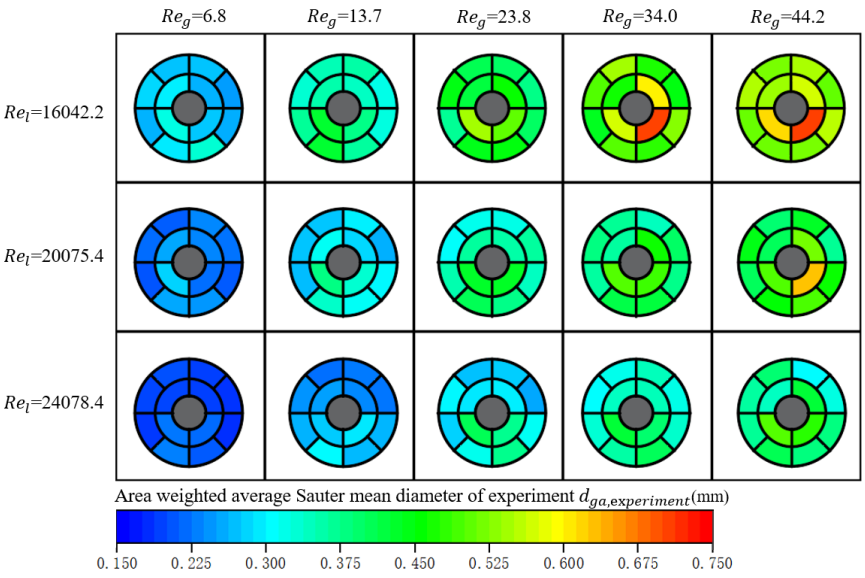

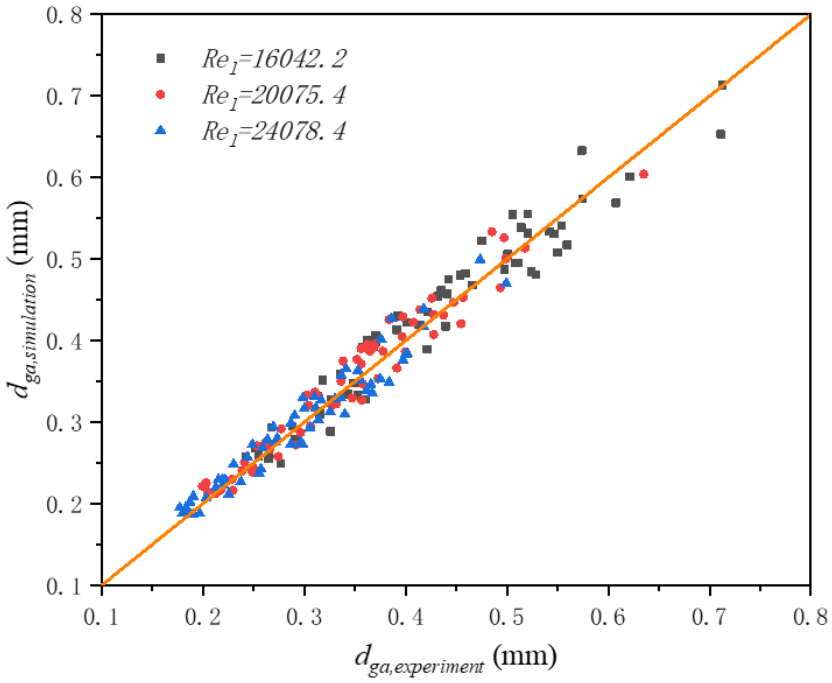

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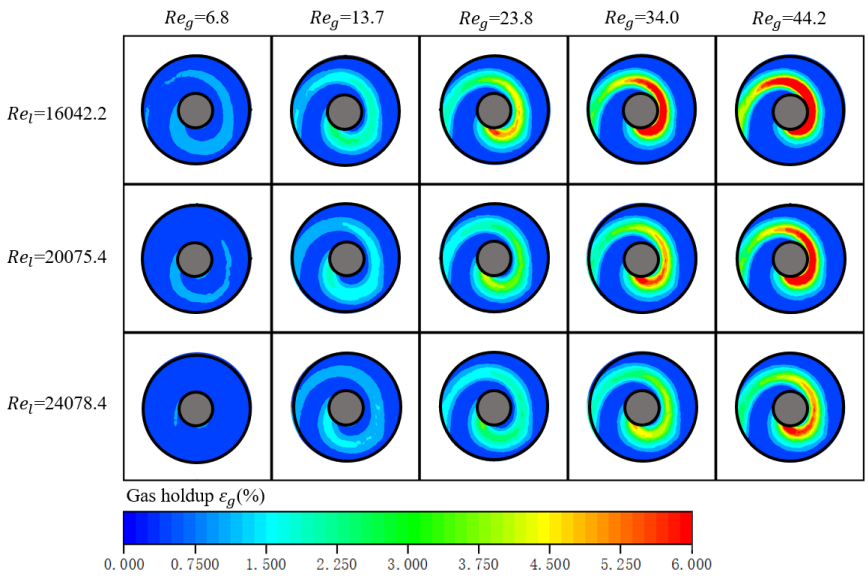

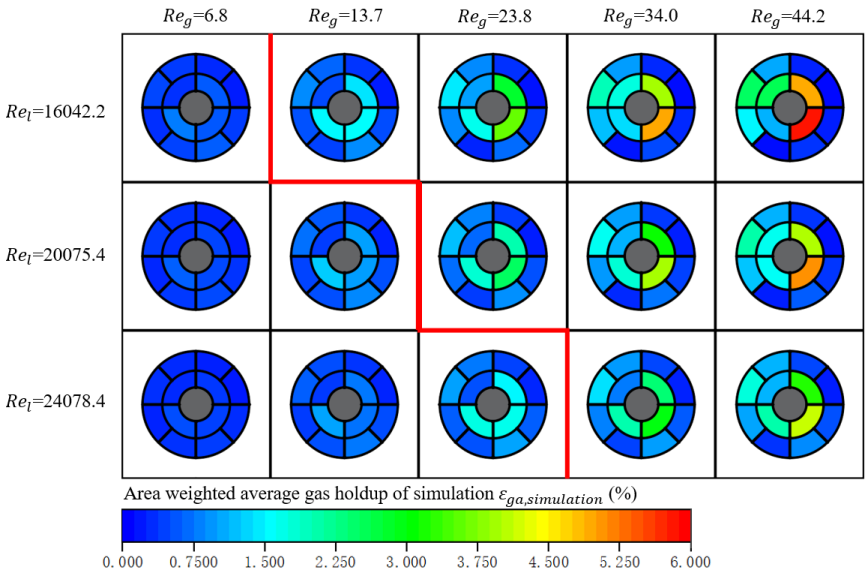

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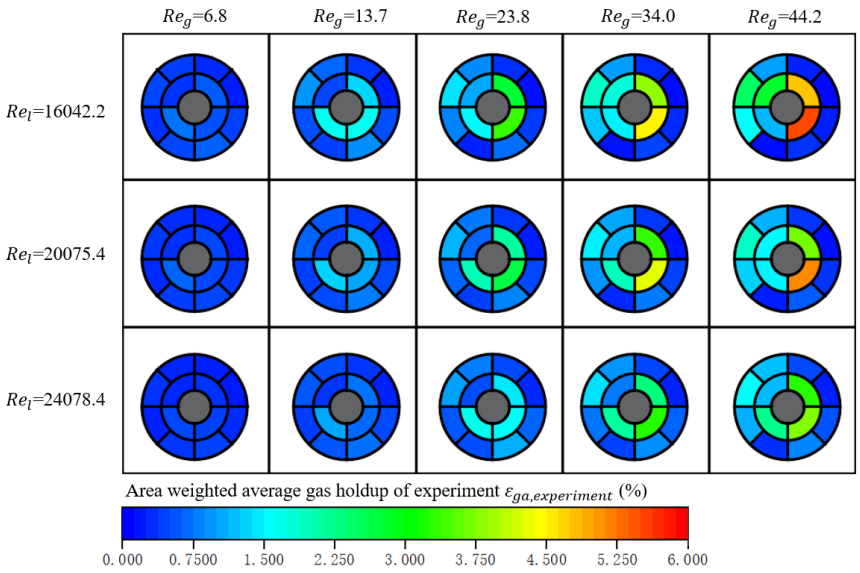

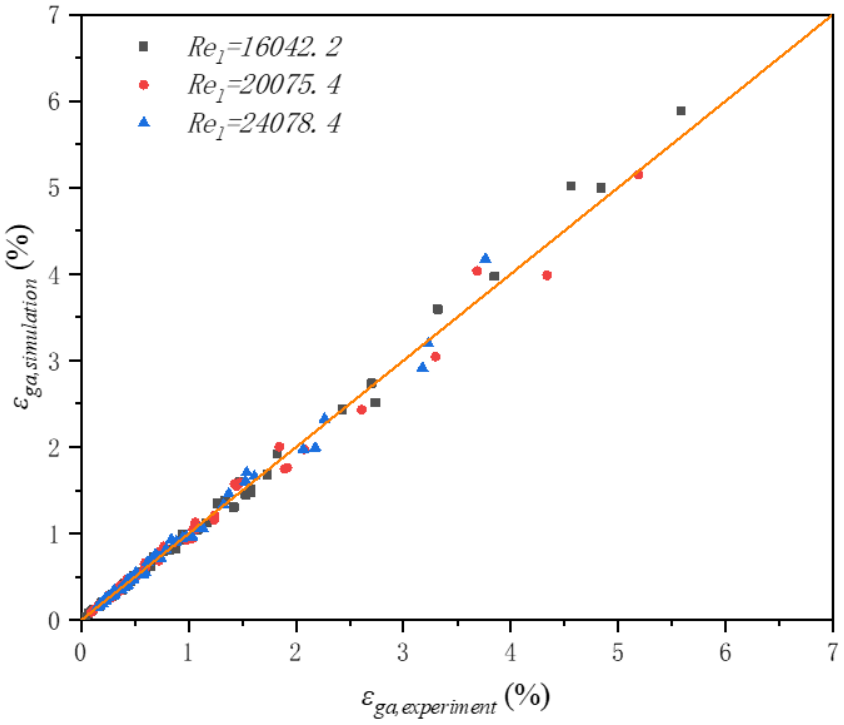

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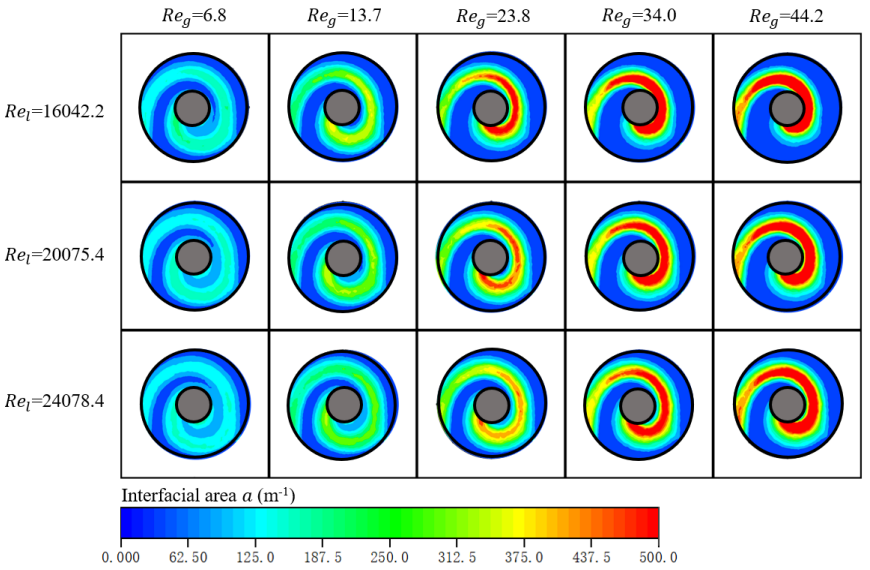

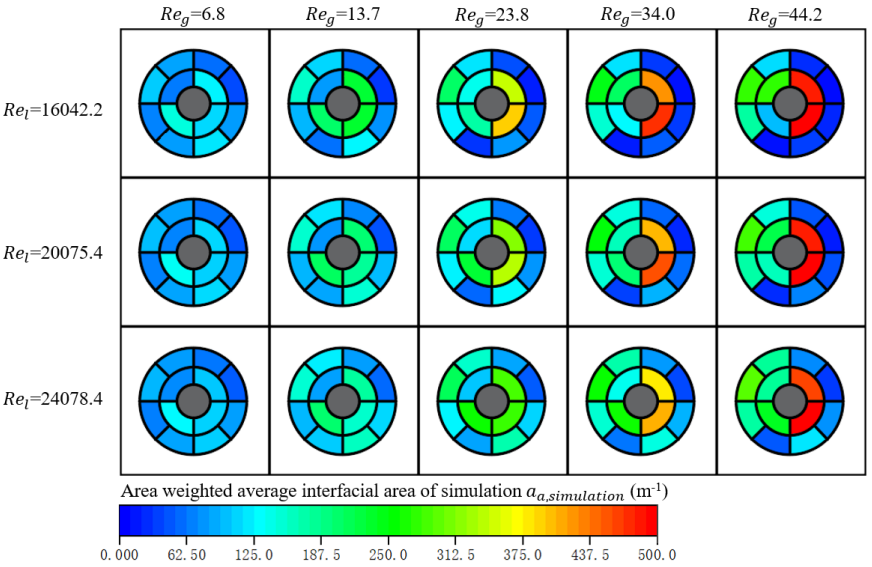

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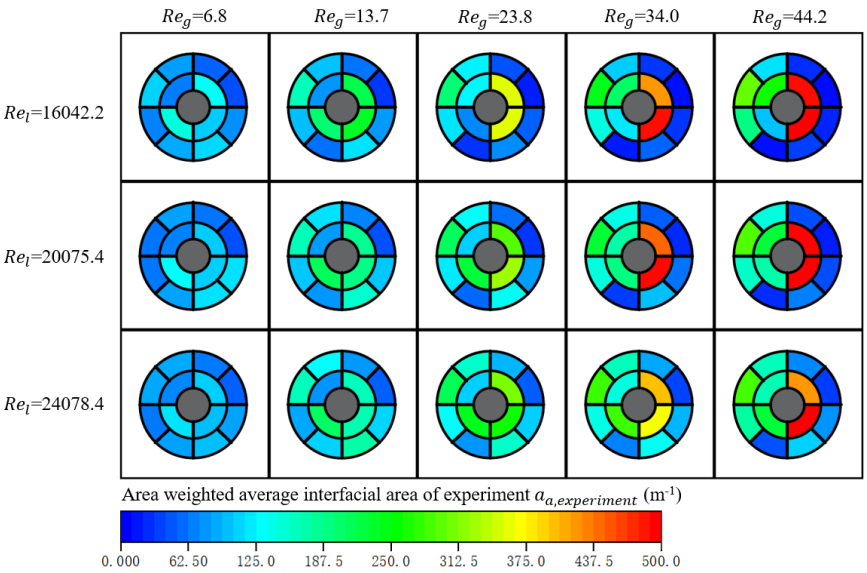

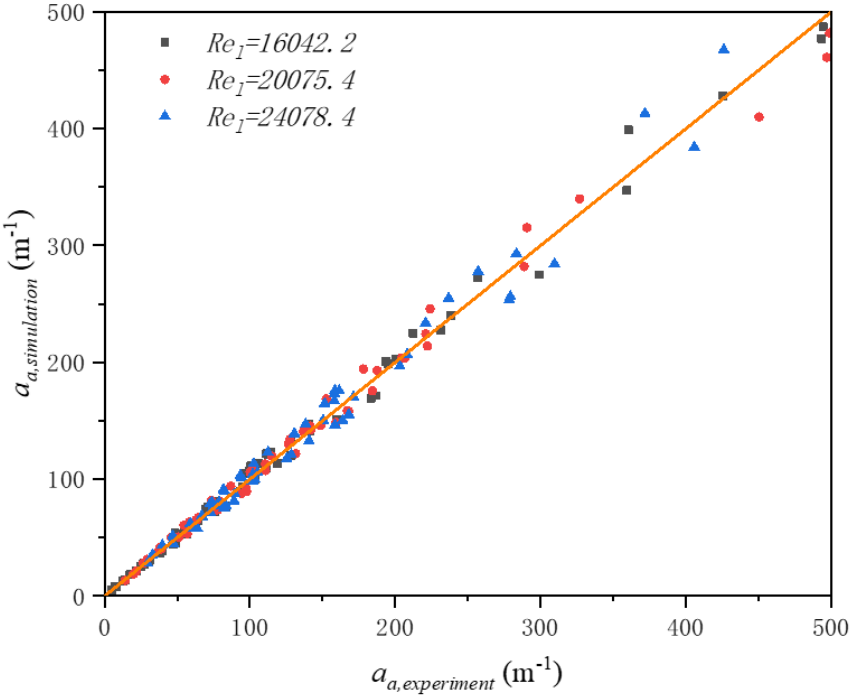

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