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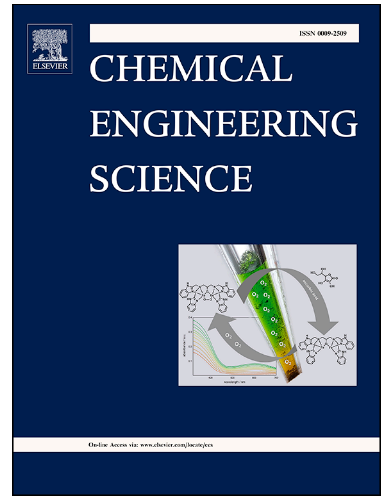

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Penetration time of hydrophilic micron particles impacting into an unconfined planar gas-liquid interface

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Abstract: The penetration time of hydrophilic micron particles during the submergence process is experimentally studied by using a high-speed camera. The effects of impact velocity (0.5m/s $\leq u_{p0} \leq$ 1.48m/s), surface tension (44.3mN/m $\leq \gamma \leq$ 73.9mN/m) and dynamic viscosity (1.31mPa·s $\leq \mu \leq$ 2.13mPa·s) on the penetration time have been investigated. The penetration time for different fluids can be expressed as two different functions with the increase of impact velocity, which are in a good accordance with the experimental results. The results show that the penetration time exhibits a power function with particle size at lower impact velocity ($u_{p0} \leq$ 0.5m/s), which increases with the surface tension decreasing and dynamic viscosity increasing. As the impact velocity increases, the penetration time can be expressed as a linear function of particle size. When the impact velocity exceeds the transition velocity (u_{p0} $\approx$ 0.74m/s), the penetration time decreases at first and then increases with the decreasing surface tension, while changing little with the increase of dynamic viscosity. The confinement effect of cavity induced by the Marangoni stress and viscous stress has been analyzed in the different surface tension and dynamic

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