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Surface-seal changes with impact speed[1] AKIHITO KIYAMA, RAFSAN RABBI, Utah State Univ, NATHAN SPEIRS, King Abdullah University of Science and Technology, JESSE BELDEN, Naval Undersea Warfare Center Division Newport, YOSHIYUKI TAGAWA, Tokyo University of Agriculture and Technology, TADD TRUSCOTT, Utah State Univ — Surface-seal is one of the most violent and complex fluid phenomena that occurs when a sphere enters the water. Surface-seal is associated with the formation of a thin splash sheet that moves up and outward at first, then inward to close above the cavity. This closure event is followed by the dramatic cavity pull-away from the free surface, with the cavity remaining but still attached to the sphere. A scaling law for the timescales of the surface-seal has been proposed by Gilbarg Anderson (1948) for the lower-speed water entry and verified by several researches for entry speeds up to 30 m/s of the sphere entry speed. In contrast, for faster speeds, the theoretical work done by Lee et al. (1997) predicted that the scaling law breaks down, yet there is still no experimental verification. Here, we show our experimental measurements on the timescales associated with surface-seal at relatively faster speeds (up to 128 m/s). Our results confirm that the conventional scaling law does break down when the sphere speed reaches a threshold value (around 90 m/s in our case) and suggests clues for the future theoretical developments.

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