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On the relationship between air entrainment, internal flows and closure mechanism in a ventilated supercavity ASHISH KARN, ROGER ARNDT, JIARONG HONG, University of Minnesota — An understanding of underlying physics behind ventilation demand is critical for the operation of underwater vehicles based on ventilated supercavitation for a number of reasons viz. gas entrainment requirements for cavity formation and sustenance. The prior studies on the ventilation demand have reported that the gas entrainment requirement to form a supercavity is substantially larger than that needed to sustain it. This phenomenon, known as ventilation hysteresis, is particularly important from the viewpoint of reduction in gas requirements. However, little physical insights into this phenomenon has yet been provided. In this study, systematic investigations are conducted into ventilation hysteresis with respect to the formation and collapse behaviors of ventilated supercavities. It is suggested that the supercavity formation process is driven by bubble coalescence, whereas its collapse is related to the pressure difference across the supercavity interface at its rear portion. Further, we examine the relationship between ventilation hysteresis, supercavity closures and air entrainment requirements for supercavity formation and sustenance under steady and unsteady flow conditions. These observations are directly related to the internal flows inside the supercavity.

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