Cavitation Mechanism under Coupling of Multi-physics and Multi-phase Flow

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Abstract Cavitation erosion is a prominent problem during the service of hydrodynamic mechanical systems. The theory of cavitation erosion has not yet been clarified. And the characteristics of cavitation erosion under different working conditions should be further explored. A multi-factor coupling cavitation test platform is developed to investigate the cavitation mechanism under the coupling of coupling of multi-physics and multiphase flow. It is revealed the cavitation erosion behavior and the response mechanism of material physical and chemical characteristics to form a complete cavitation physical model and theory. Aiming to serve in extreme conditions such as deep sea, polar regions, etc., it is established that a multi-parameter working condition database including load of wind and wave, ambient temperature, salinity, solid particles, gas content, etc. The cavitation performance of typical anti-cavitation materials is systematically evaluated under complex operating conditions. Moreover, its internal relationship between the cavitation properties and the basic physical and chemical properties of the material (hardness, tensile strength, elongation at break, fatigue strength, corrosion resistance, etc.) is explored with the establishment of relationship model consisting of structure, physical and chemical properties and cavitation properties for the prediction criteria of the cavitation performance. It could provide theoretical and data support for the leapfrog development of anti-cavitation materials and high-performance hydrodynamic mechanical systems, which has important academic value and significant application prospects.

Keywords Cavitation erosion; Multi-physics; Multi-phase Flow; Coupling effect.

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