

Abstract Proposal

Recent Investigations on Cavitation Erosion  
at the University of Grenoble

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Bubble clusters are one of the most common forms of cavitation. As an example, for the hydrofoil shown in Fig. 1, a two-phase cavity develops from the leading edge of the foil. This cavity, which is highly unstable, generates cavitation clouds that are shed more or less periodically in the wake. They are made of various types of vapor structures including bubbles and cavitating vortices.



Fig. 1 : Cloud cavitation on a hydrofoil

The dynamics of bubble clusters play a prominent role in cavitation and more especially in cavitation erosion. Cavitation clouds are a major source of damage in real cavitating flows e.g.



Fig. 2 : An example of cavitation erosion damage

around marine propellers. Fig. 2 shows a typical example of the long term damage caused to a material surface by the repeated collapse of cavitation clouds.

The proposed presentation aims at providing an overview of the researches on cavitation erosion conducted recently at the Laboratory of Geophysical and Industrial Flows (LEGI) of the University of Grenoble (France).

The early stage of cavitation erosion – the incubation period – will be presented in detail. During this stage, damage is characterized by isolated pits (see Fig. 3) that are expected to result each from the collapse of a single vapor structure. It will be shown that the combination of pitting tests and nanoindentation tests make it possible to estimate the spectrum of impact loads applied to the wall. Such a spectrum can be considered as a measurement of the aggressiveness of the cavitating flow and, to some extent, as an indicator of the bubbles in the cluster that collapse close to the wall.

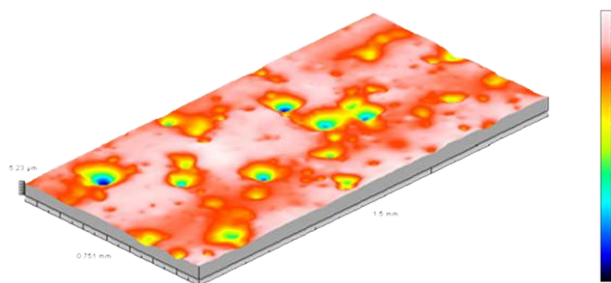


Fig. 3 : Typical damage during the incubation period

The presentation will also discuss direct measurements of impact loads using conventional pressure sensors. The damage during the more advanced stages of erosion due to the repeated loading of the wall will be discussed. A phenomenological model will also be presented that enables to analyze how a ductile material behaves in a cavitating flow and understand the various stages of the erosion process, from pitting to material failure and mass loss.