# Effect of surface finish process on the cavitation erosion of austenitic steel and nickel-aluminium bronze

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Cavitation is described as the formation and collapse of gas bubbles in fluids due to local pressure changes. The implosion of these bubbles in the immediate vicinity of a surface can lead to shock waves and microjets, inducing plastic deformation and erosion of the material. The wear resistance of materials is highly influenced by the surface properties of the material. One simple way to change these properties is to change the surface topography via the final manufacturing step. For cavitation erosion it is oftentimes assumed that a smoother surface finish will yield better erosion resistance. In other cases, surface structuring is attempted to reduce the aggressiveness of cavitation attack on a surface. Nevertheless, the effects of surface properties on cavitation erosion are not fully understood to date. In this study the damage evolution during ultrasonic cavitation of an austenitic steel (316L; 1.4441) and a nickel-aluminium bronze (NAB; CuAl10Ni5Fe5) at two different surface roughness values (ground with 80 grit sandpaper and polished with silica) were investigated, using light microscopy, confocal microscopy, as well as scanning electron microscopy and transmission electron microscopy. Additionally, the mass loss curves were recorded during the experiments.

For short ultrasonic cavitation times both surface states of the 316L show the same erosion progress. After approximately 1h the polished samples start to develop a higher mass loss rate. For the NAB there is a higher mass loss for the ground samples in the early stage of the experiments. But as the experiment progresses, also the polished surface state assumes a higher mass loss rate. Microscopy shows that for the NAB, tips of the grinding marks are removed early, because they have undergone embrittlement due to strain hardening. Less deformed regions later on show enhanced erosion resistance. For 316L a finely recrystallized subsurface layer is found after grinding, which effectively delays the onset of erosion. Once the affected subsurface material has been removed, samples with both surface finishes assume the same erosion behaviour.

This study shows that surface finishing by polishing did not improve the cavitation resistance of the materials. On the contrary, strain hardening induced by grinding appears to delay the onset of erosion under cavitation.

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