Cavitation instabilities between fibres in a metal matrix composite - DTU Orbit (09/11/2017)

Cavitation instabilities between fibres in a metal matrix composite

Short fibre reinforced metal matrix composites (MMC) are studied here to investigate the possibility that a cavitation instability can develop in the metal matrix. The high stress levels needed for a cavitation instability may occur in metal–ceramic systems due to the constraint on plastic flow induced by bonding to the ceramics that only show elastic deformation. In an MMC the stress state in the metal matrix is highly non-uniform, varying between regions where shear stresses are dominant and regions where hydrostatic tension is strong. An Al–SiC whisker composite with a periodic pattern of transversely staggered fibres is here modelled by using an axisymmetric cell model analysis. First the critical stress level is determined for a cavitation instability in an infinite solid made of the Al matrix material. By studying composites with different distributions and aspect ratios of the fibres it is shown that regions between fibre ends may develop hydrostatic tensile stresses high enough to exceed the critical level for a cavitation instability. For cases where a void is located in such regions it is shown that unstable cavity growth develops when the void is initially much smaller than the highly stressed region of the material.

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