

Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Stress induced cavitation for the streaming motion of a viscous liquid past a sphere JUAN PADRINO, DANIEL JOSEPH, University of Minnesota, TOSHIO FUNADA, Numazu College of Technology, Japan, JING WANG, University of Minnesota — Cavitation induced by stresses in the streaming flow of a viscous liquid past a stationary sphere is studied here. The maximum tension criterion for cavitation used here was proposed by Joseph 1995, 1998: “Liquids at atmospheric pressure which cannot withstand tension will cavitate when and where tensile stresses due to motion exceed one atmosphere. A cavity will open in the direction of the maximum tensile stress which is 45° from the plane of shearing in pure shear of a Newtonian fluid.” The analysis leads to a dimensionless expression for the maximum tensile stress as a function of position which depends on the cavitation and Reynolds numbers. The main conclusion is that at a fixed cavitation number the cavitation threshold decreases with the Reynolds number and the extent of the region of flow at risk to cavitation increases as the Reynolds number decreases. This prediction that more viscous liquids at a fixed cavitation number are at greater risk to cavitation seems not to be addressed, affirmed or denied, in the cavitation literature known to us.

Jing Wang
Univeristy of Minnesota

Date submitted: 09 Aug 2005

Electronic form version 1.4