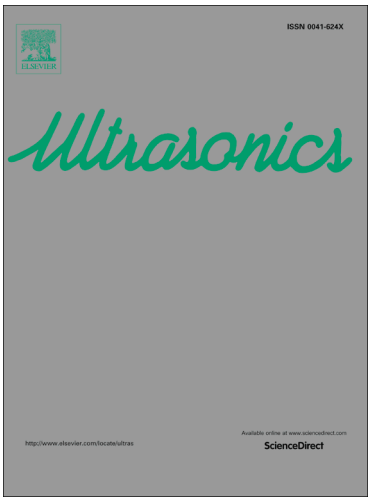


Short communication

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# Peening the tip of a notch using ultrasonic cavitation

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## Abstract

A peening technique using ultrasonic cavitation was proposed to peen the tip of deep notches. The working theory of the present peening technique for the notch tip was described and numerically demonstrated. An experiment using a deep notch shape and an ultrasonic loading with a frequency of 20 kHz achieved noticeable compressive residual stresses at the notch tip.

**Keywords: Peening; Ultrasonic; Cavitation; Notch; Tip**

## Introduction

Notches introduced in mechanical components substantially degrade structural durability due to the stress concentration when the components are subject to tension. To improve the durability, the tensile stress concentration at the tip needs to be mitigated. Shot peening, which is to impact the surface with shot streams and produce a compressive residual stress layer, has been used to relieve the tensile stress concentration. However, for deep and narrow notches, shot peening becomes less suitable to peen the tips of the notches due to the difficult geometries, which are challenging to access.

To address the challenges to peen deep notches, we propose a shot-less peening approach using ultrasonic cavitation. When water is ultrasonically excited, cavities form and grow. When the cavities reach a volume where energy can be no longer absorbed, they collapse violently generating shockwaves. Early works using the shock waves demonstrated compressive residual stresses on flat metal surfaces or increases of the fatigue limit [1, 2, 3], which implies that ultrasonic cavitation is able to provide surface treatment like shot peening. The