

# Ultrasonically assisted drilling of fine-grained marble

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## Abstract

Marble is generally used in construction and decorative works, for instance, for exterior and interior decorations of the buildings. Thus, visible damages in marble can make its unusable for such applications, leading to significant financial costs. Therefore, the aim of the study is to minimize a negative impact of marble machining to avoid defect formation.

Ultrasonically assisted drilling (UAD) is a technique where high-frequency and low-amplitude vibration is superimposed on the movement of a drill bit in a drilling operation. UAD of various materials resulted in decreasing of cutting forces (thrust force and torque) and improvement of the drilling quality when compared to conventional drilling. Therefore, to reduce cutting-induced damage, UAD of marble was investigated. The experiments were carried out with fine-grained white marble. To determine the optimal drilling parameters, the marble samples were drilled with two types of drill bits and different spindle speeds and feed rates.

In this study, drilling parameters and tools, most suitable for maximal reduction of thrust force and torque, were determined. An effect of a loss of the ultrasound action in UAD was obtained at the cutting speeds of 370 rpm and 800 rpm. Further investigation indicated that it was caused by accumulation of marble dust inside a drilled hole, preventing vibrational motion of the drill bit.

## Keywords

Ultrasonically assisted drilling; Marble; Thrust force