



## The spalling strength of ultra-fiber reinforced cement mortar

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### ABSTRACT

This is a research report about the effects of polypropylene fiber and wood fiber on mechanical properties of cement mortar. First, using advanced Hopkinson pressure bar (HPB) tests, it investigates the wave propagation in cement mortar comprised polypropylene fiber and wood fiber. Second, according to the experiment, the spallation position is recorded by high-speed camera. Thirdly, it analyzes the test data of ultra-fiber reinforced and common cement mortar by numerical method. Finally, it deduces the spalling strength of all kinds of cement mortar by integrating all experimental data above. The results indicate that, compared with the strength of common cement mortar, the dynamic spalling strength of ultra-fiber especially that of the polypropylene fiber reinforced cement mortar increases evidently. However, adding too much fibers will deteriorate the dynamic spalling strength of cement mortar specimen. So the results will provide a test basis for further optimizing performance of cement mortar.

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### 1. Introduction

It is well known that the evolution of micro-cracks will significantly affect the strength of materials. In order to improve the tensile strength, several fibers are used to restrain cracks extending in concrete materials. Nowadays the fibers reinforced concretes are widely used in construction and buildings, such as steel fiber reinforced concrete (SFRC) [1], synthetic fiber reinforced concrete (SNFPC) [2], carbon fiber reinforced concrete (CFRC) [3] and wood fiber reinforced concrete (WFRC) [4]. Fiber-reinforced concrete can be also used as a material of seawater resistance, because the erosion damage of concrete is related to the tensile strength of the material [5,6].

Under dynamic loads, such as seawater scouring, explosion, earthquake, wind load and so on, the dynamic properties of the fiber reinforced concrete is quite different from those of concrete under static loads [7,8]. Since 1917, Abrams [9] found that strain rate hugely affected the mechanical behavior of concrete. Many attentions are focused on the dynamic behavior of concrete in the past of three decades. Some researchers [10,11] have gotten a lot results of the studies at dynamic tensile strength, but not been concerned with the dynamic spalling strength of fiber reinforced cement mortar.

In this paper, advanced (Hopkinson pressure bar) HPB is adopted to test the dynamic spalling strength of fiber reinforced cement mortar. And two kinds of fibers, polypropylene fiber and wood fiber are chosen to form fiber reinforced cement mortar. Based on that the spalling strength and the spallation position of samples are determined by both the experimental results of advanced HPB tests and numerical analysis, this article will discuss the effect of fiber content on the spalling strength.

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