

Effects of Polyvinyl Alcohol Fiber on Bond Behavior between Concrete and Steel Rebar

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Abstract

The effects of Polyvinyl alcohol (PVA) fibers on the bonding behavior between reinforcement and concrete is studied by experiments. The effects of PVA fibers, rebar diameter and cover depth on bond behavior are clarified. Results show that PVA fibers affect negatively on bonding in ascending branches both for the pull-out and splitting cases, but improve the bonding in descending branches after peak stress for splitting case. In the present test, the maximum decrement of bond strength is about 16.2% with PVA fiber less than 0.6%. PVA fibers restricts both the macro-cracking and micro-cracking for splitting case, the former one seems much more significant than later one. The effects of rebar diameter and cover depth on bonding become slight and significant with increment content of PVA fibers, respectively.

Keywords: polyvinyl alcohol fiber; bond behavior; mechanical performance; experimental study.

1 Introduction

Extensive works have been carried out to investigate the effects of PVA fibers on mechanical properties of concrete. It has been reported that PVA fiber increased the splitting tensile strength and flexure strength of concrete as compared to plain concrete [1]. The adding of PVA fibers affects slightly the pre-cracking behavior of concrete but improved substantially the post-cracking response, enhancing the ductility and toughness [2-3]. Nuruddin et al. [4, 5] studied and compared the effects of PVA fibers on the static and dynamic behavior of concrete and structures. It found that the static behaviors of concrete were improved while the dynamic properties were not affected as the low content of PVA fibers [4]. PVA fibers, however, improved the ductility and damping ratio of the concrete beams under four-point loading cases [5]. Some works have also been performed to study the durability of PVA fiber reinforced

concrete. It reported that PVA fibers enhanced the frost resistance, carbonization resistance and fatigue life of concrete [6]. Nowadays, however, very few works have been performed to clarify the effects of PVA fibers on bond behavior between concrete and steel rebars.

The bonding between concrete and steel rebars is a key factor for concrete structures, which relates to the designing, construction and behavior of structures [7]. In the past few years, lots of works have been performed to study the bond performance between steel rebar and fiber reinforced concrete [8-9]. Most of these works, however, focused on the cases with steel fibers and steel-PVA hybrid fibers. Some of these reported that the addition of steel fibers resulted in more ductile bond behavior and the bond strength increases with the increment content of steel fibers [10]. While some others hold that the addition fibers show no measurable effect or even