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THERMAL-MECHANICAL BEHAVIORS OF CFRP-ECC HYBRID UNDER ELEVATED TEMPERATURES

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ABSTRACT: Carbon fiber reinforced polymer (CFRP) composites have been accepted for the strengthening of concrete structures. Polymer adhesives are generally adopted for bonding CFRP to the concrete substrate. These polymer adhesives have been facing challenges due to elevated temperatures in fire. Although cementitious adhesives were proposed to replace polymer adhesives, they were found brittle and could hardly sustain high temperatures due to spalling. In the current study, engineered cementitious composite (ECC) was used as the adhesive, and a CFRP-ECC hybrid was externally bonded to the concrete structures for strengthening purpose. ECC shows desirable strain hardening and multi cracking properties in tension, and its anti-spalling behavior has also been proved. This paper presents fundamental studies on the material properties of ECC under elevated temperatures up to 500 ^{o}C. The compressive and tensile strengths of ECC under room temperature in this paper were 45.7 MPa and 3.5 MPa respectively. The properties started to drop at 300 ^{o}C (compression) and 200 ^{o}C (tension). The temperature effects on the interface bonding between CFRP and ECC were also investigated through direct pulled-out tests. Mortar specimens were also prepared for the comparison with the ECC specimens. The experimental results showed that ECC could sustain the elevated temperatures without spalling. The strain hardening and multi