Accepted Manuscript

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PII: S0958-9465(17)30720-5

DOI: 10.1016/j.cemconcomp.2018.01.007

Reference: CECO 2976

To appear in: *Cement and Concrete Composites*

Received Date: 11 August 2017

Revised Date: 4 January 2018

Accepted Date: 8 January 2018

Please cite this article as: J.-Y. Wang, J.-Y. Guo, Damage investigation of ultra high performance concrete under direct tensile test using acoustic emission techniques, *Cement and Concrete Composites* (2018), doi: 10.1016/j.cemconcomp.2018.01.007.

Damage investigation of ultra high performance concrete under direct tensile test using acoustic emission techniques

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ABSTRACT

In this study, acoustic emission (AE) analysis method was applied to monitor the damage evolution process of ultra high performance concrete (UHPC) under direct tensile test. Three types of UHPCs, including high strain-hardening UHPC, low strain-hardening UHPC and strain-softening UHPC were investigated. Meanwhile, the crack width developments of UHPCs during the tensile test were measured. Test results show that high strain-hardening UHPC exhibited high ductility by forming multiple microcracks invisible to naked eyes (typically below 0.05mm) in the strain-hardening stage. The crack width-strain curves indicate that increasing the ultimate tensile strain of UHPC can improve its crack width control ability effectively. The AE analysis method could effectively detect the internal damages of the high strain-hardening UHPC at a strain of 600με. At that time, the crack width was smaller than 0.01mm that could not be detected by crack width measuring instrument in this study. For three types of UHPCs, damages were generated around the localized crack during the strain-softening stage. In a word, the AE analysis method provides strong evidence to the multiple cracking behavior of UHPC during the strain-hardening stage, and provides a clear explanation to the identical damage evolution mechanism for three types of UHPCs during the strain-softening stage.

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