High Performance Concrete with Post-Tensioning Shrinking Fibers

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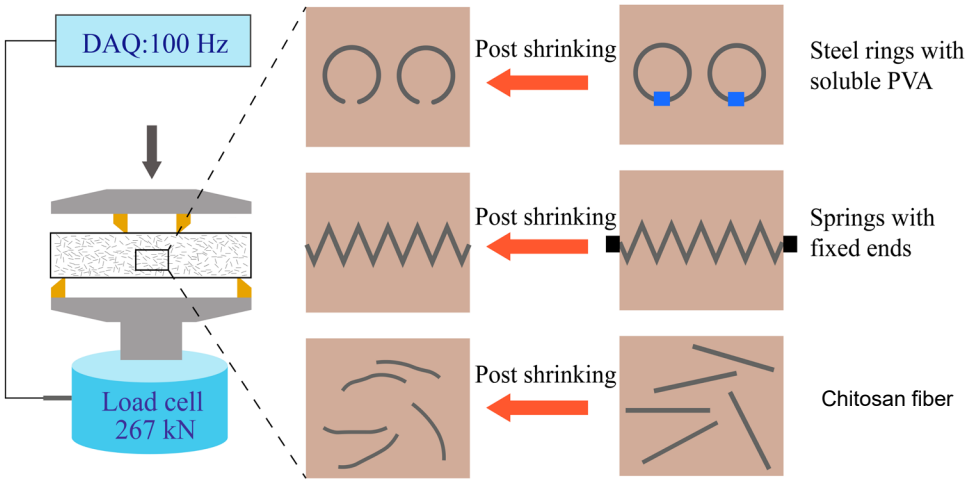
Abstract

Concrete failure is often catastrophic due to the high compressive strength but brittle nature of the material. Nature is one of the biggest of opponents of concrete with freeze/thaw cycles and salt degrading concrete and expanding cracks. The goal is to develop high performance concrete using post-cure active prestressing fibers. The current focus is on using steel rings and springs to prestress the concrete. Chitosan fibers are the focus of the next phase. Shrinking in high pH environments like concrete makes chitosan fibers a great candidate for shrinking. Concrete beams cast from quick-set concrete were tested in a four-point bending test. The prestressed rings were held open with water soluble 3-D printing filament. Steel springs are pre-tensioned in a mold with concrete poured around them. Steel rings were added to the concrete without the PVA insert and control springs were added without being pre-stretched. Flexural tests were conducted with constant displacement rate of 0.15 in/min, and a sampling rate of 100 Hz, together with acoustic emission monitoring. It was found that pre-stressed steel rings increased flexural strength and increased post failure ductility relative to the control rings. Steel springs showed no change in flexural strength but showed increased post failure ductility. Present work is being done with chitosan fibers as the concrete pre-stressor and novel shrinking fiber reinforced concrete with be further investigated.



Acknowledgements: Zhang Liu assisted in testing and concrete specimen preparation. Robert Worley II assisted with acoustic emission monitoring.