Improving 3D Cement Printing (3DCP) Applications: The Fresh and Hardened Properties of Bentonite Clay and Nanoclay Augmented CementApplications in 3D Cement Printing (3DCP)

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The demand for sustainable housing is a universal problem. Nearly 1.6 billion people worldwide lack some form of adequate housing. 3D cement printing (3DCP) is a promising source of affordable, sustainable, long-term housing. 3DCP allows for cheaper and faster home construction and with impact on the environment. However, the interactions with wet cement and the printer and its environment are complicating 3DCP reducing efficiency. The primary water-associated problems are water leakage because of pressure from the extruder pistons and water loss due to evaporation post-printing. To mitigate these issues, bentonite and nanobentonite clays were tested as additives to cement, due to their water absorption and retention properties. The study found that the addition of bentonite and nano-bentonite clays decreased cement bleeding and increased water retention; however, nanobentonite was much more effective in producing desirable results. Heat flow analysis revealed that nanobentonite and bentonite clays also accelerated the hydration reactions behind cement hardening and that the bentonite and nanobentonite were linked to an increase in cement compressive strength. The results of this study should be further analyzed for specific applications. The implications of perfecting the 3DCP process could be critical for sustainable improvement of the developing world.

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