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Synthesis of a novel humidity self-regulating material from riverbed sediment for simulating cave dwellings performance

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Abstract

With simulation of the cave dwellings' performance of warming in winter and cooling in summer, a humidity self-regulating material was first synthesized with riverbed sediment. A tough and porous building material could be obtained under hydrothermal conditions, and tobermorite formation during hydrothermal process was found to have a capability of improving both strength and porosity of the specimens. The solidified sediment specimens with the molar ratios of CaO to SiO₂ (C/S) of 0.4 and 0.8 could enhance the moisture adsorption/desorption capacity evidently. With extra sepiolite addition, the moisture adsorption/desorption and humidity regulating capacities could be further improved due to the coexistence of tobermorite and sepiolite. For example with extra 30 mass% sepiolite addition, the amount of moisture adsorption/desorption increased nearly two times and the RH variation decreased by a factor of two comparable to that of without sepiolite addition. As such, the hydrothermally solidified riverbed sediment can be used as the "cave-dwelling"

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