

Earthen materials: processing and rheological requirements



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ABSTRACT:

Earth-based materials are currently receiving a great deal of attention as sustainable and local construction materials with sufficient mechanical strength for affordable solutions worldwide. However, unlike concrete and cement-based materials, only a few studies address the rheological behaviour of these materials and its relationship to the processing route. It should be noted that there is a wide range of processing routes for earth-based materials, which imposes different rheological or consistency requirements for earth-based materials. Depending on their nature and water content, earth-based materials can be granular, pasty or fluid, making them more suitable for some processing methods than others. It is shown here that in vernacular construction techniques, the nature of the earth and the consistencies achievable have dictated the processing routes and influenced the material's hardening properties or lifespan. Inspired by these observations, it is now necessary to adapt the properties of the 'fresh' material to the processing methods (or vice versa) in order to obtain the best from the materials in terms of mechanical properties and service life. To achieve this objective, concepts derived from the design and processing of concrete mixes, as well as geotechnical and rheological characterisation tools, can be used and applied beneficially to earth construction. For example, the use of admixtures may be a solution to design and cast earth-like concrete or to meet the rheological requirements of 3D printing methods. The presentation aims to give an overview of earth construction methods with material specifications and rheological requirements. Finally, the effects of different admixtures on the processing of earth are also presented, with an emphasis on bio-based solutions.