6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 15 June 2018, Glasgow, UK

NUMERICAL, ANALYTICAL, AND EXPERIMENTAL STUDY OF THE PULLOUT BEHAVIOR OF POLY (VINYL ALCOHOL) FIBERS EMBEDDED IN CALCIUM PHOSPHATE CEMENT MATRIX

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Key Words: *Calcium Phosphate Cements, Pullout Test, Fiber-Matrix Bond Strength.*

In recent years, calcium phosphate cements (CPCs) have attracted significant interest in medical applications due to their chemical similarity to bones and teeth [1]. However, the application of CPCs is hindered by their high brittleness and poor mechanical properties that restrict their use to non-load-bearing anatomical sites. Reinforcement of CPCs with polymer fibers, such as poly (vinyl alcohol) (PVA) fibers, can overcome the mechanical limitations of CPCs. Fiber reinforced calcium phosphate cements (FRCPCs) could therefore be a potential option to expedite the use of advanced bone substitutes in load bearing applications [2].

The overall goal of this study is to investigate and optimize the interfacial properties and bond-slip response between the CPC matrix and PVA fiber. The effects of parameters influencing the fiber pullout response, such as fiber embedded length and fiber diameter, are investigated by means of laboratory tests, analytical, and numerical modeling. For the analytical modeling, an interfacial law is proposed for the frictional behavior between fiber and matrix. Furthermore, numerical simulations of the pullout test are conducted to obtain a deeper understanding of local fiber-matrix interactions. The analytical and numerical models are tuned with the experimental results.

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