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Bacteria can enhance mechanical strength of a porous medium

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A class of bacterium, *S. pasteurii* can mediate the precipitation of calcium carbonate crystals under the right chemical environment. These crystals can enter a network of pores in a porous medium and cause clogging. As a result, the structure may gain strength significantly and exhibit superior mechanical properties. This is characterized by reduction in porosity, physical pore blockage and increase in elastic moduli. This concept may be extended to a wide array of applications like underground carbon storage and repairing fractures in fragile structures. In the present study, open foam sponges of two different grades were used as porous media mimics. We performed comprehensive material testing on samples before and after bacterial treatment and drew quantitative conclusions. We tested the samples under compressive and impact loads and characterized the modification in mechanical behavior due to pore clogging. Visual observation of the actual blockage process at the pore scale was performed using Scanning Electron Microscopy (SEM) and micro-CT scans. We noticed a significant change in mechanical properties. To conclude, this bacterium may be used as an agent to cause pore-clogging at the microscale and the idea applied to a range of applications.

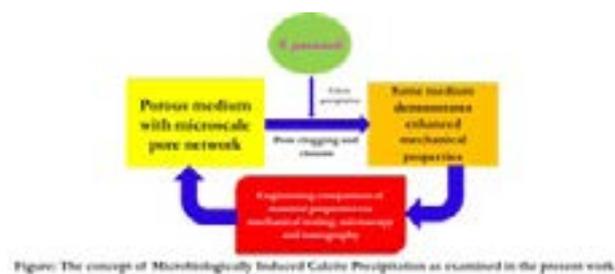


Figure: The concept of Microbiologically Induced Calcite Precipitation as examined in the present work

Biography

Swayamdipta Bhaduri is a PhD Candidate in Engineering at the Ingenuity Lab in the University of Alberta, Edmonton. He has been working on the several biological, chemical and physical aspects of the micro-scale fluid transport associated with Microbiologically Induced Calcite Precipitation (MICP) mediated by *S. pasteurii*. His expertise lies in the areas of nanofabrication, biomicrofluidics, and experimental fluid mechanics. He has an MS and a Bachelor's degree in Mechanical Engineering from the Indian Institute of Technology (IIT) and the National Institute of Technology (NIT) in India, respectively.

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