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Enhancing backfill thermal properties by combining granular phase change materials, graphite and glass

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Phase change materials (PCMs) can store and release heat at a relatively constant temperature. Incorporating PCMs into mixtures for backfill materials may improve their thermal energy density and thus contribute to the enhancement of borehole thermal energy storage and shallow geothermal energy systems. However, PCMs might reduce the overall heat transfer between the borehole and the surrounding ground because of their low thermal conductivity. Thus, other additives may be needed to improve the effective thermal conductivity of the backfill-ground system, while maintaining desirable heat capacity and then the corresponding efficiency of the shallow geothermal systems. This study incorporates encapsulated PCMs (EPCMs) and graphite into glass fines with the purpose of using the mixtures as backfill materials. The heat capacity and thermal conductivity of mixtures with different content of each component are measured in the laboratory. In addition, a computed tomography slice, which contains EPCMs, graphite, glass, and air phases, is selected to study the heat transfer at the particle scale. The experimental data agree with the simulated results. The findings in this study can be used in geothermal system design and contribute to the transition from fossil-based energy systems to renewable energy sources.

Participation

In-Person

References

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Energy Transition Focused Abstracts

This abstract is related to Energy Transition

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