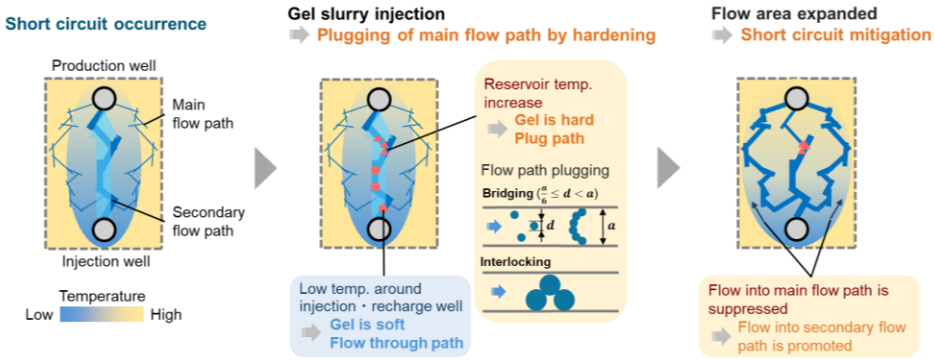
Tohoku Univ. Technology

Selective Flow Control in Geothermal Reservoirs via Short-Circuit Mitigation

Temperature-Responsive Gel for Preferential Fracture Plugging



Overview

Geothermal energy is recovered by injecting fluid through injection wells, allowing it to absorb heat as it flows through rock fractures, and extracting the heated fluid via production wells. Preferential flow through highly permeable fractures can cause short-circuiting, where injected fluid reaches the production well without sufficient heat exchange, reducing power generation efficiency. Currently, no effective method exists to mitigate short-circuiting, and operators are limited to temporary measures such as adjusting injection rates or switching wells.

The inventors have identified a potential solution using a temperature-responsive gel that solidifies at high temperatures. When injected, the gel slurry flows into preferential flow channels and selectively plugs them upon reaching the high-temperature reservoir zone, redistributing fluid flow to other fractures and improving heat recovery efficiency.

Product Application

- ☐ Mitigation of short-circuiting in geothermal reservoirs
- ☐ Potential use in geological formations hosting radioactive waste repositories to prevent fluid leakage

IP Data

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Controlled Fluid Diversion to Secondary Flow Pathways

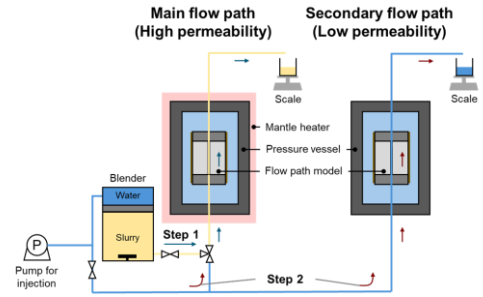

Figure 1. Schematic of water permeability testing upon preferential flow path plugging with multiple flow channels.

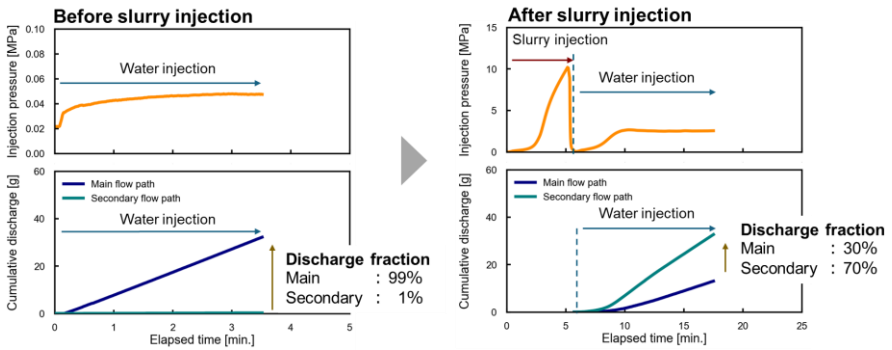

Figure 2. Injection pressure and permeability before and after gel injection. Permeability through secondary flow channels increased after preferential path plugging.

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