

# LICENSING OPPORTUNITY

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## Rock drilling in great depths by thermal fragmentation

### Keywords

Spallation drilling, Thermal fragmentation, Controllable heat flux, Alternating heating and cooling, Deep heat mining, Geothermal energy, Hard rock formation, water-based drilling fluid, Hydrothermal flame, High density drilling

### Summary

The presented technology represents a smart method to thermally fragment rock for excavation of vertical and directional boreholes in rock formations. The invention is based on highly exothermic reactions in the presence of a water-based drilling fluid and aims at combining advantages of rotary and thermal spallation drilling techniques (fig. 1).

### Background

In the construction of geothermal power plants, conventional rotary drilling processes still represent the major costs. Lines have to be drilled up to several kilometers depth for making the geothermal energy reservoirs accessible. These high costs mainly arise due to the fast wear out and the consequent replacement of the drill bit when hard polycrystalline rock is drilled in great depth. Thus, considerable and expensive down times are inevitable when using conventional rotary drilling methods. The presented contact free rock fragmentation technology is expected to overcome this economic shortcoming.

### Invention

The drilling concept is environmentally friendly and use a hydrothermal flame jet in an aqueous environment of water based drilling fluid. This will be exposed to the rock surface, heat it up rapidly and cause high thermal stresses in the upper rock layer due to thermal expansion. Based on the stress, thermally induced fragmentation occurs and disk like rock spallation zone (fig. 2 and 3). The formed rock cuttings are transported upwards in an annular stream of drilling fluid in between drill string and borehole wall.

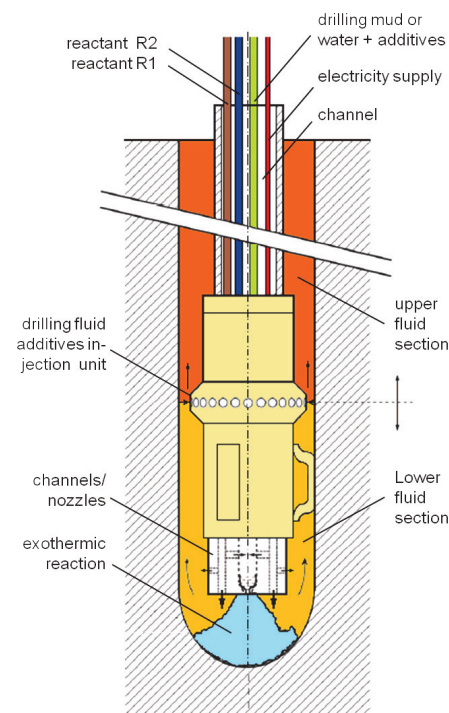


Fig. 1: An embodiment of a down-hole drilling assembly

### Patent Status

- Patent pending PCT

### Features & Benefits

- Less expensive downtimes during drilling operation
- Thermal fragmentation in high density environment
- Improved transport of rock cuttings
- Expected high penetration rates in hard rock formations
- Controllable heat flux to the rock
- Alternating heating and cooling

### Field of Application

- Drill holes in great depth for geothermal energy
- Drilling of on- and offshore extraction lines / extra or heavy oil recovery
- Improvement of oil recovery via an in-situ combustion (ISC) process

### References

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## Rock drilling in great depths by thermal fragmentation (cont.)

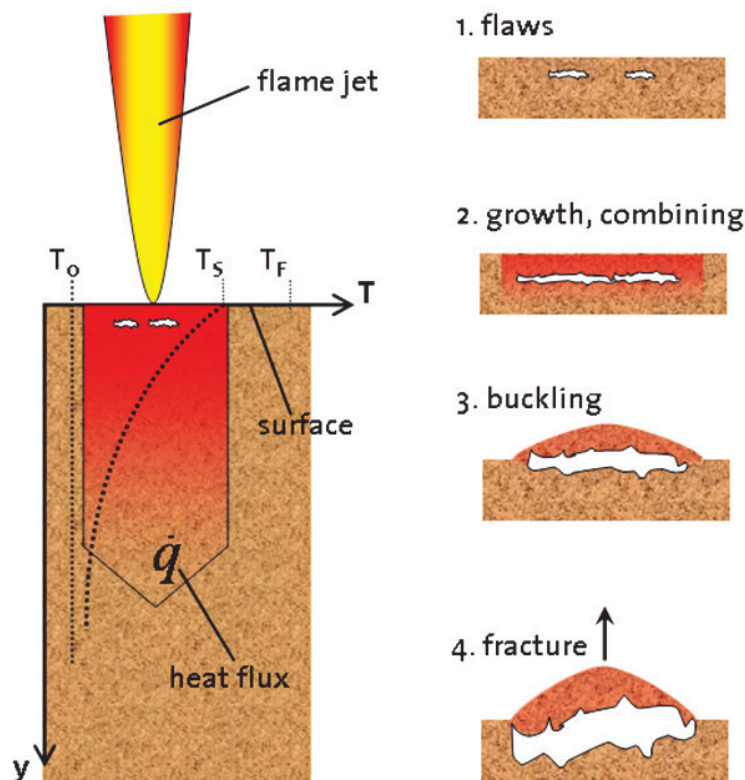


Fig. 2: Principle of hydrothermal spallation drilling

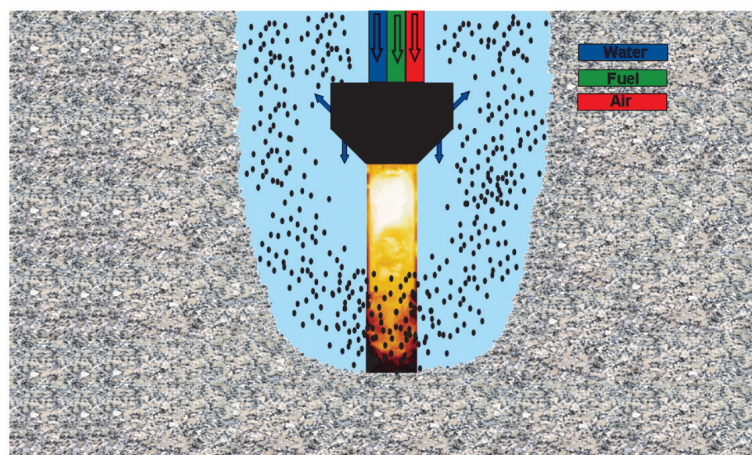


Fig. 3: Sketch of the downhole assembly in operation

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