



## **Interaction of ceramic proppants with geothermal brine: an experimental study of their reactivity**

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High resistant ceramic proppants (diameter  $\sim 1$  mm) are spherical particles commonly added to fracturing fluid to stabilize induced fractures and to enhance the productivity of the geothermal reservoirs.

Major aim of this work is to determine if and to which extent calcinated bauxite proppants ( $\text{Al}_2\text{O}_3$ :83 wt. %;  $\text{SiO}_2$ : 5 wt. %;  $\text{TiO}_2$ : 3.5 wt. %;  $\text{Fe}_2\text{O}_3$ : 7 wt. %; other: 1.5 wt. %) both phenol resin coated and uncoated, as injected to the reservoir Größ Schönebeck (GrSK), Germany, would release aluminium (Al) in geothermal fluids. Colloidal or dissolved Al could be transported along the pores and fractures and precipitate elsewhere at appropriate conditions. Thereby Al minerals could clog the transport pathways and reduce productivity and injectivity respectively.

To simulate the chemical environment of GrSK reservoir we used either a GrSK fluid, containing 65-85 mg/L  $\text{SiO}_2$ , 54000 mg/L Ca and 38400 mg/L Na or different synthetic solutions (NaCl 1M, NaCl-CaCl<sub>2</sub>5M, GrSK fluid, NaCl 1M +  $\text{SiO}_2$ (50 mg/L)) in Teflon autoclaves at  $\sim 2$  bar either in an oven at 150°C or at ambient conditions for 8 to 12 weeks.

Proppants were analyzed with a Scanning Electron Microscope (SEM) and chemically semi-quantitatively with EDX (Energy Dispersive X-ray spectroscopy) before and after treatment. After the experiments the solutions were separated, filtrated (20  $\mu\text{m}$ ) and analyzed for Si, Al and Fe by ICP-OES. The SEM pictures show that secondary minerals formed on the surface are mainly constituted by Na, Ca, with traces of Si and Fe. No Al was detected. In the filtrate only Si was detected, whereas Al and Fe were not found. No significant difference in the Si concentration between resin coated and uncoated proppants could be seen. It turned out that most Si (138 ppm) was measured in the solution with the highest pH (7).

These first experiments indicate no Al, but Si release during the interaction of the ceramic proppants with the brines. Preliminary conclusions show no difference in the behavior of coated and uncoated proppants. Future investigation should focus on the influence under high pressure of proppants on geothermal brines of a wider chemical composition range.