

# GeoCoat – High Performance Coatings For Aggressive Geothermal Environments

By Geo-Coat consortium



Geothermal energy, the thermal energy sourced from the earth, is one of the natural sources of the energy that has been in use since pre-historic times. Despite its natural abundance and potential as the next-generation low-carbon energy technology, the exploitation of geothermal resources continue to remain a challenge – the deployment of geothermal energy in renewable electricity generation is largely eclipsed by solar and wind power.

Geothermal resources are naturally aggressive environments with the integrity of geothermal power plant components more often compromised due to inherent high temperatures, pressure and predominance of the corrosive species in geofluids. The threat is increased as wells move to deeper geothermal resources – geofluids become all the more antagonistic, multiplying the corrosion, erosion, and scaling effects.

Geo-Coat (<http://www.geo-coat.eu/>) is a collaborative initiative aimed at providing an integrated framework to develop novel corrosion- and erosion- resistant coating systems specifically

tailored to meet the differing needs of specific geothermal environments. The project builds on the experiences of materials science and flow assurance technologies in the oil and gas sector – transfer the lessons learnt to the geothermal arena. “Our target is to design new high-performance coatings to resist specific issues, or combinations of issues as experimentally derived at key failure points within geothermal power plants”, says the team of experts in Geo-Coat.

## Geo-Coat innovations

Geothermal sources exhibit a wide range and combination of degradation mechanisms, resulting from high temperatures and the aggressive chemical make-up of the brines, coupled with the pressure drops and chemistry changes that occur at different points in the process and equipment. As such, there is a clear need for improved surface resistance in geothermal applications.

The Geo-Coat project develops specialized corrosion- and erosion- resistant coatings, based on selected High Entropy Alloys (HEAs) and Ceramic/ Metal mixtures (Cermets), to be applied through thermal powder coating techniques (primarily high velocity forms of HVOF / Laser cladding) specially

developed to provide the required bond strength, hardness and density for these challenging applications. Given that there is no single material or coating solution possible, Geo-Coat targets to design these new high performance coatings to resist each of the specified threats or combinations of threats, as experimentally derived at key failure points within geothermal runs, and to apply them only to the affected components. The project, thus builds a knowledge-based matrix of key problems and solutions that can be modeled and applied more widely, allowing the design of highly resistant systems with minimized costs.

Flow assurance modeling is a relatively new area and is rapidly becoming widely used in the oil & gas industry where it is considered to be one of the most important key technologies for efficient, economical and safe oil & gas production<sup>1</sup>. The Geo-Coat flow assurance simulator comprising various geofluid models will provide information on pressure, flow velocities, temperatures, and geofluid compositions in the whole system, thereby setting the performance requirements for the coating methodology selection at each process point. Additionally, the Geo-Coat Decision Support System (DSS) with the relevant information from the models and database will help produce reliable lifecycle estimates for performance, operational costs, environmental impacts and risk.

### Geo-Coat consortium

The Geo-Coat consortium consists of 11 members<sup>2</sup> including research institutes, SMEs and end users. The project is led by TWI, a foremost independent research and technology organization in the UK<sup>3</sup>.

### Acknowledgement

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<sup>1</sup> Multiphase technology – the best Norwegian invention since 1980, [https://www.ife.no/en/ife/ife\\_news/2012/flerfaseteknologien-beste-norske-oppfinnelse-siden-1980](https://www.ife.no/en/ife/ife_news/2012/flerfaseteknologien-beste-norske-oppfinnelse-siden-1980)

<sup>2</sup> <http://www.geo-coat.eu/consortium/>

<sup>3</sup> <https://www.twi-global.com/who-we-are>



Sampling for steam. Photo courtesy Orkuveita Reykjavíkur SF.



Sampling for water. Photo courtesy Orkuveita Reykjavíkur SF.