

# Ceramic Plugs for Well Sealing Applications

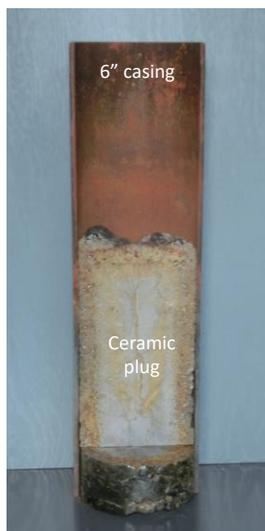
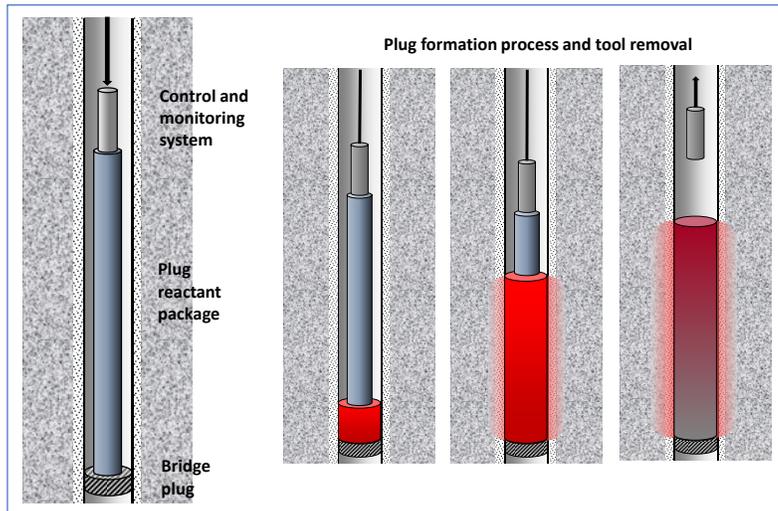
High performance systems for challenging downhole environments

## The problems

Extreme thermal, pressure, and corrosion environments challenge conventional sealing materials, particularly for long term performance requirements. The surface preparation, fluid nature, and cure time of cements impose wait times and uncertainties in their overall integrity and location, particularly in more dynamic downhole environments.

## The solution

Olympic Research is developing plug and seal components based on self-propagating high-temperature synthesis (SHS) processes. The system uses the thermal energy of solid phase metal/oxide reactions, supplemented by mixtures of minerals and oxides, to form ceramic seals in place. The formed products have superior physical and chemical properties compared to cements.



## Applications

- HP/HT oil and gas
- Geothermal energy extraction
- CO<sub>2</sub> injection/sequestration
- Deep borehole storage of radioactive waste

## About Olympic Research, Inc.

Olympic Research, Inc. develops solutions to challenging environmental, energy, and geotechnical problems. The staff and research capabilities encompass environmental fate and transport, physics, earth science, materials science, and engineering development. For more information visit our website at [www.olympic-research.com](http://www.olympic-research.com).

## Key properties and benefits

### Ceramic plug material properties:

- Matrix permeability <math>\leq 1 \mu\text{D}</math>
- Compressive strength 25-30 kpsi
- Casing bond strength 500-800 psi
- Service temperature >1000°C
- Very high corrosion resistance

### Field benefits:

- ✓ Wireline emplacement
- ✓ Rapid emplacement and formation (< 1 hr)
- ✓ Design strength in hours instead of days
- ✓ Manufactured system delivered to site: no mixing or pumping of fluids at surface

## Emplacement

ORI ceramic plugs are formed by lowering packages of reactive charge material to the desired depth in the well. The SHS reaction initiates at the base of the package, and the product fills the well as the reaction progresses up the package. A five meter plug will form completely in five minutes, and will achieve its design strength in less than five hours.

