ELEMENTAL
Degradable technology frac balls

APPLICATION
- Temporary isolation of zones during multistage stimulation operations in cemented and uncemented wells

BENEFITS
- Unrestricted flow after stimulation, ensuring that production reaches its full potential
- Uninterrupted operations that accelerate time to production
- Degradable technology that minimizes risk of lost production due to stuck balls
- Elimination of interventions to remove frac balls, saving time and costs and minimizing QHSE risks

FEATURES
- Proprietary degradable alloy that is stronger than conventional alloys
- Compatibility with brine and other common water-based stimulation fluids, including slickwater, linear gel, cross-linked gel, and foams
- Ability to hold pressure under a broad range of bottomhole conditions
- Ability to withstand differential pressures up to 10,000 psi [69 MPa] and temperatures up to 300 degF [150 degC]
- Predictable degradability based on fluid and downhole conditions

ELEMENTAL® degradable technology frac balls are designed for multistage stimulation operations in cemented and uncemented wells. The balls degrade predictably and fully at bottomhole conditions—without the need for chemical additives, an acidic environment, retrieval operations, or milling after fracturing. No production is lost after stimulation as a result of stuck balls, which ensures that production always reaches its full potential.

Degradability is highly predictable
Extensive testing at a wide range of temperatures and pressures showed that the material made with ELEMENTAL technology degrades predictably in common water-based stimulation fluids such as brines, slick water, and cross-linked fluids. Water alone causes the balls to fully degrade in a matter of hours to a few days, even under very low temperatures, without the need for acid or other additives.

Predictive models aid planning
Mathematical models based on fluid and downhole conditions are used to predict degradation time and facilitate planning for a wide variety of downhole conditions.

ELEMENTAL technology balls degrade predictably in a wide variety of downhole conditions. In temperatures > 250 degF [121 degC], for example, disintegration takes place in 12 hours or less, depending on downhole conditions.
Degradable balls are compatible with existing systems

Degradable balls used with the Falcon* and nZone* multistage stimulation systems and Copperhead* drillable bridge and flow-through frac plugs enable high-stage-count jobs to be carried out in both cemented and uncemented wells by eliminating the need to mill out any balls that do not flow back during the cleanup stage.

Microgalvanic electrochemical cells in the alloy made with ELEMENTAL technology derive their electrical energy from a spontaneous chemical reaction taking place in the cells. This oxidation-reduction reaction accelerates the dissolution process, allowing the balls to fully degrade within hours or days, depending on variables such as ball size and downhole conditions.

<table>
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<tr>
<th>ELEMENTAL Degradable Technology Ball Specifications</th>
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<tr>
<td>Working temperature range, degF [degC]*</td>
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<td>Max. differential pressure, psi [MPa]</td>
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*Reservoir temperature may be higher, depending on application, once cool-down effect is considered.