VDA
Viscoelastic diverting acid

APPLICATIONS
■ Stimulation of
  ● Oil and gas carbonate reservoirs
  ● Reservoirs with multiple layers, long production intervals, or permeability variation
  ● Horizontal and vertical wells
■ Multilayered and reservoirs with long production intervals
■ Bullheading or pumping through coiled tubing

BENEFITS
■ Self-diverting acid system
■ Operation as sole treating fluid or in combination with other fluids
■ Increased zonal coverage
■ No residual formation damage
■ Single treatment fluid for simplified operations
■ Easy fluid recovery and well cleanup
■ Solids- and polymer-free
■ Rated to 300 degF [149 degC]
■ Rapid viscosity development on acid spending
■ Viscosity reduction on contact with hydrocarbon

In matrix stimulation of oil and gas carbonate formations, the objective is total zonal coverage. While the use of diverters has been well-proven, most diverter methods use particulates that, post-treatment, can damage the formation.

For cost effectiveness and ease of operation, the ideal system is one that can be bullheaded, is self-diverting, and leaves no residual damage.

Unique properties for extended application
Existing technologies for self-diverting systems rely on polymer-based fluids that can result in post-treatment residual damage. Additionally, conventional acid systems are limited to bottomhole conditions of approximately 200 degF (93 degC). The VDA® viscoelastic diverting acid is rated to 300 degF and eliminates the damage associated with solids and polymers in matrix treatment. VDA acid can be used as the sole treating fluid or with other treating acids for diversion.

Diverted flow for ideal treatment
VDA acid maintains an ideal thin consistency while being pumped into the well. Upon acid spending, the fluid rapidly develops viscosity in situ and becomes self-diverting. The viscosity buildup serves as a barrier to reduce the development of dominating wormholes and allows fluid movement to stimulate other untreated zones.

Furthermore, VDA acid can be bullheaded and still provide total zonal coverage. In horizontal and extended-reach wells, VDA acid is ideal for pumping through coiled tubing as these wells contain no solids that could cause bridging.

In reservoirs with multiple layers or long production intervals, the rapid buildup in viscosity creates a temporary barrier that diverts the remaining fresh acid into the more highly damaged or lower-permeability zone. It is the development of viscosity that reduces fluid leakoff and gives the fluid its self-diverting property, which ensures coverage of the entire interval.
**Low-pressure cleanup**

Following treatment, the barrier is broken down by hydrocarbon production or by dilution with formation fluids, giving rise to easy recovery and well cleanup. Because only low pressures are required for well cleanup, operations are simplified and cleanup costs are reduced.

**Effective chemical diversion results in uniform production, minimal drawdown**

In a recent application, the effects of VDA acid diversion to increase zonal coverage and improve permeability were evaluated by a major customer. On an existing single completion trial candidate in the Middle East, the test demonstrated that VDA acid helped achieve not only diversion goals but stimulation objectives as well. Interpretive results from this test would determine whether the advanced VDA acid could provide effective chemical diversion for use in dual completions that were scheduled.

The test well had five different sets of perforations totaling 133 ft and extending through varying lithologies; the permeability contrast among the five zones varied from 3 to 600 mD.

A treatment design consisting of VDA acid for diversion and SXE* emulsified acid for deep penetration was selected. Prior to treatment, a pressure buildup analysis showed a large skin of +100; following stimulation using VDA acid and SXE acid, a second well test showed that skin was reduced to −3. Comparisons of the prewell and postwell production logging and test analyses showed an oil production increase, from 510 to 1,730 bbl/d at the same choke size.

Additionally, the wellhead pressure showed a five-fold increase; flowing bottomhole pressure doubled. The self-diverting VDA acid reached all producing zones. An increase in wellbore flowing pressure and the shape of the buildup curve also showed a reduction in formation skin.

Before treatment, the production logging tool density and spinner curves indicated that the bottom set of perforations was not producing fluid. Data also indicated that only some of the perforations within the upper four zones contributed to total flow. Production logs after the acid treatment with VDA acid and SXE acid showed that all perforations throughout the five zones now contributed to total flow.

As a result of this field trial, VDA acid was deemed appropriate for use without coiled tubing in dual completions and raised expectations for future self-diverting VDA acid treatments in the area.