

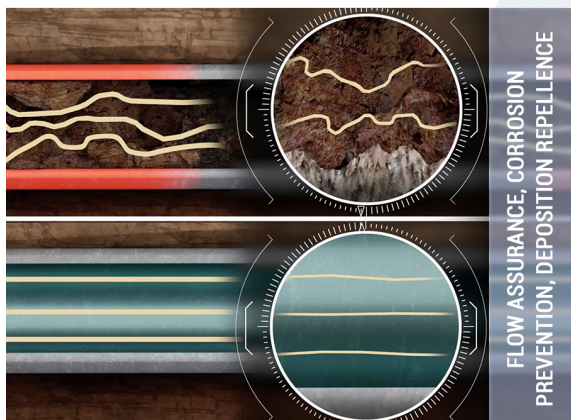
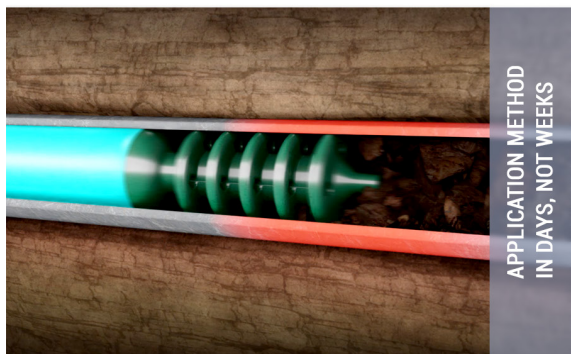
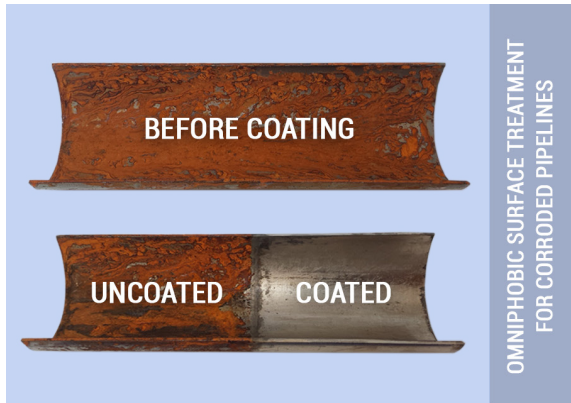
A BREAKTHROUGH PIPELINE SURFACE TREATMENT

DragX™ is a novel surface treatment system for pipeline integrity that utilizes nanocomposite technology to create a durable, low-friction internal pipe surface. The treatment provides flow assurance and prevents corrosion as well as deposition and adhesion along pipeline walls. DragX™ can lower operational costs, maintenance & repair costs and reduce overall pipeline down-times. The omniphobic nanocomposite is effective for all flow regimes.

DragX™ was developed as a novel surface treatment system for use in a variety of pipelines. Development was supported by the U.S. Department of Energy (DOE), U.S. National Energy Technology Laboratory (NETL), and the U.S. Environmental Protection Agency (EPA). DragX utilizes nanocomposite technology to create a water & oil-repellant, low- friction surface - even on corroded, in-service pipelines.

The surface treatment is applicable on long, in-situ pipelines and is scalable to any Pipe diameter. DragX™ is effective at a fraction of the thickness of conventional pipeline epoxy coatings (2 mil), while imparting drag reduction, preventing corrosion, and reducing adhesion & deposition of unwanted debris and impurities.

The energy industry has embraced the numerous benefits found in using factory- applied, flow-efficiency coatings for pipelines. These benefits include increased efficiency & throughput, reduced pressure drop, reductions in power use for pumping, mitigation of corrosion on internal pipe surfaces, reduction in adhesion of debris & paraffin, and reductions in the cost of inspection, cleaning & maintenance.



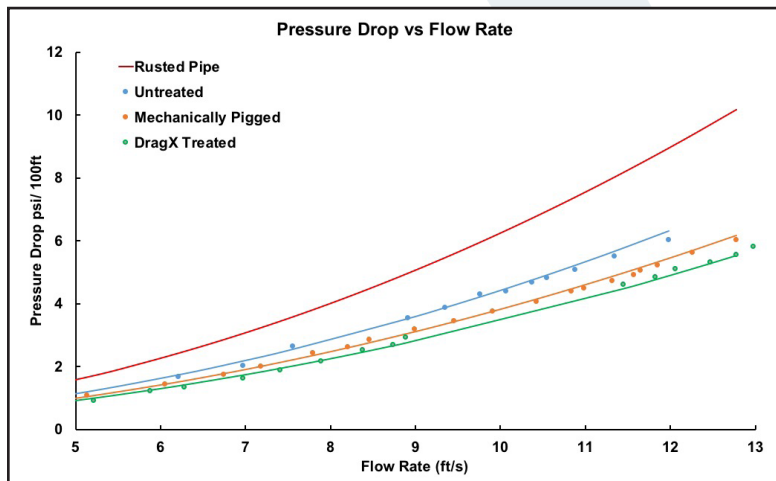
How DragX Works:

DragX™ is applied via pigging and dries within hours. It creates an ultra-thin and slick passivating, omniphobic layer which both protects against corrosion and repels deposition on the pipe wall. DragX™ has strong adhesion, abrasion-resistance, no adverse effects on purity of the fluids being transported, and increases flow capacities at decreased pressure; even for derated pipelines.

Key Benefits:

- Reduced need for use of costly inhibitors, or need eliminated altogether
- Eliminated need for continuous injection of costly chemicals and need for injection equipment and maintenance
- Increased throughput & lowered power consumption
- No adverse effects on purity of the fluids transported
- Increased flow capacity at decreased pressures for de-rated pipelines
- Protection against internal corrosion and black powder formation or build-up

PRESSURE DROP VS. FLOW RATE



MATERIAL	Relative Pressure Drop vs. Untreated Line
Steel pipe, heavily corroded	150%
Steel pipe, lightly corroded	100%
Steel pipe, after traditional pigging	90%
DragX™ treated pipe	75%

- In field trials, DragX™ could reduce pressure drop within a treated line by up to 25% when applied to a relatively clean, lightly corroded line
- In comparison, traditional mechanical pigging and cleaning can only achieve improvement of 10% and this effect is only temporary
- On heavily corroded lines, DragX™ could reduce the pressure drop losses by a factor of 2