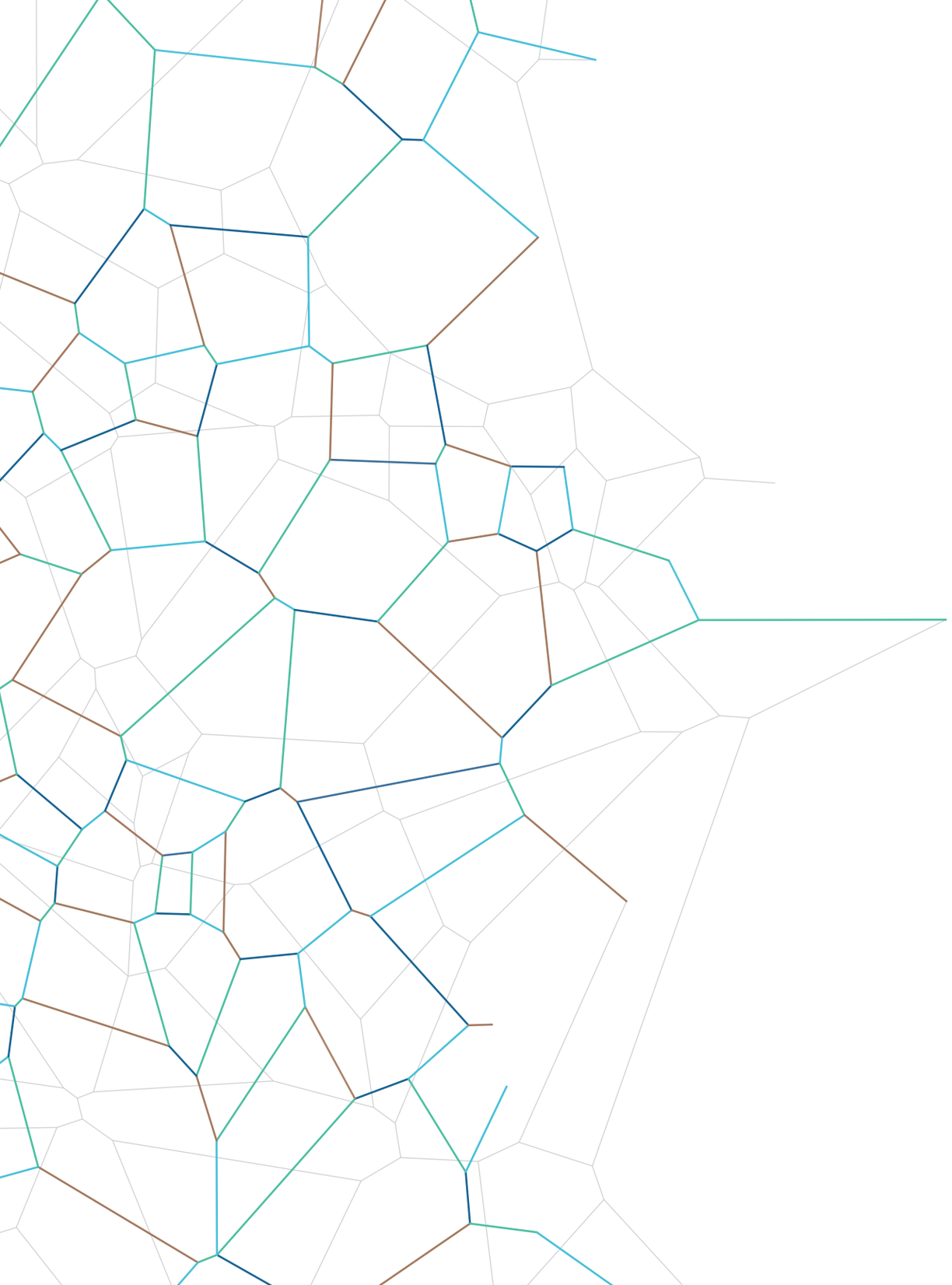


Crystaphase

# Let’s be clear.

There’s no magic behind reactor performance.

# It’s not magic.
# It’s science.

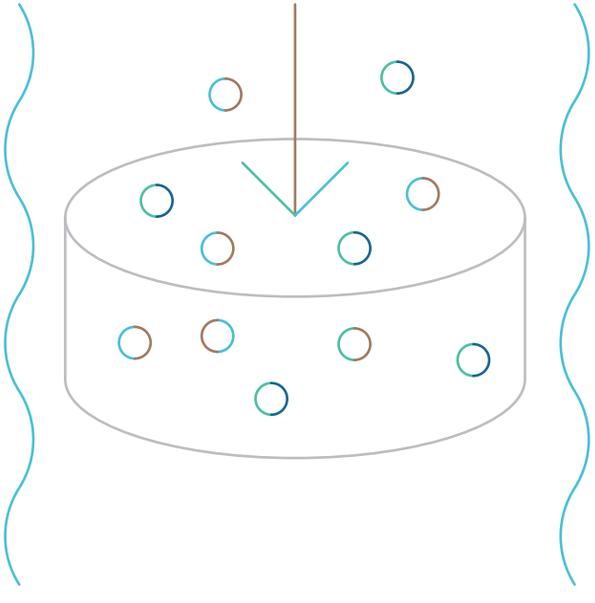
Hydroprocessors know the wall that lies between them and peak reactor performance. Fouling, pressure drop, precipitation, agglomeration, polymerization, and catalyst deactivation – these obstacles build up, block by block. We help you break through that wall, clearing your path to performance.

With highly specialized expertise and unique, industry-proven solutions, Crystaphase has helped refiners all over the world achieve unprecedented efficiency and profitability.

## Two phases of optimization

Using a proprietary internal filtration design, Crystaphase eliminates crusting during **purification**, maintaining uniform distribution during **dispersion**. Working together, these solutions lengthen your production cycle and improve your reactor’s performance.

Suspended particles and poisons interfere with catalyst performance. Foulants build up, creating rivulets that compound the problem. Our space-saving solutions remove soluble and insoluble compounds from feedstocks, maximizing productivity and profitability.



Improve throughput
by as much as

50%

Extend production
cycles by as much as

1,000%

Increase catalyst load
utilization by as much as

300%

# Two sides of some serious coin.

## Less downtime

Downtime costs money. Shutdowns cost millions per day in lost profitability. Every day comes with added risk to your operations and employees. Crystaphase helps you reduce the accumulation of foulant and mitigate pressure drop issues. This allows you to safely flatten the curve – the one that cuts into your reactor's profitability – so that you can produce for significantly longer cycles. But don't stop there.

## Greater throughput

Consider what diminished throughput can cost you over the course of your production cycle. If you have a foulant problem silently choking off your productivity by 10 percent, you could be leaving millions of dollars on the table without even realizing it.

Our job is to ensure your catalyst can do its job. Our customized purification and dispersion solutions maximize reactivity, using space more efficiently than traditional solutions and leaving you more room for catalyst.

Downtime

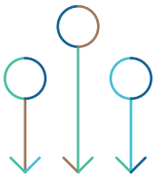
$1 million/day
× 10 days

$10 million

Throughput

$100,000/day
× 365 days

$36.5 million



## Total in unrealized profitability

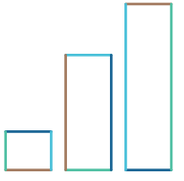
## $46.5 million

A river of lost profits runs through it. Complex interactions, distribution patterns, suspended particles, and catalyst poisons all converge to cost you money. Our solutions have been proven worldwide to extend production cycles and improve throughput – in ways that dramatically impact your bottom line.

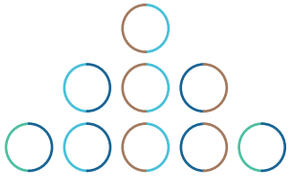
# The benefits, crystal clear.

Mitigate
pressure drop

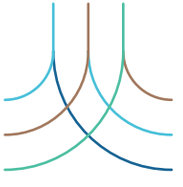
Extend
production cycles



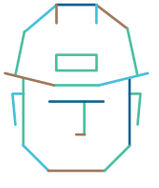
Increase yield
and selectivity



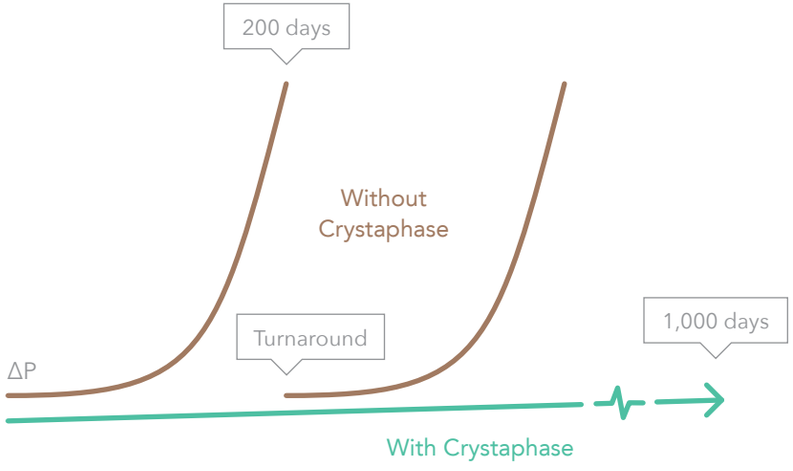
Maximize catalyst
load capacity



Improve lateral flow
distribution



Reduce risk to
employees and
equipment




## Fight the curve

As crust layers begin to develop in your reactor, the pressure-drop curve begins its precipitous rise, with a shutdown not far behind. Our laboratory and technical service team can help you identify the foulants in your system, design a customized solution to eliminate them from your performance equation, and help you dramatically extend your production cycles.

## Don’t settle for a stock solution

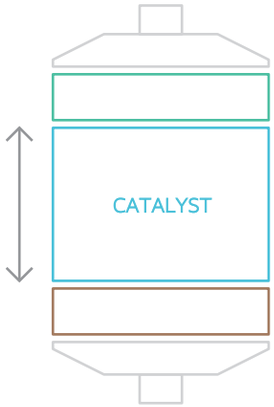
No two reactors are alike. The same can be said for feedstocks. To optimize performance, it’s imperative to understand the unique processes occurring in your system – not only the type of foulant choking off your productivity, but where and how it’s developing.

Crystaphase is thorough, using comprehensive lab testing, unique analytical tools, and simulation models to pinpoint your problem and design a customized solution based on precise feed and fouling data.

## What’s in your feedstock?

Crystaphase has solutions for a variety of soluble and insoluble foulants, including diolefins, coke, iron naphthenates, metals, silica fines, defoaming agents, proppants, silicon, salts, iron sulfide, arsenic, polymerization, and corrosion.

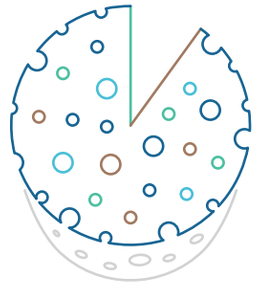

The
secret's
inside.




## Advanced purification

Crystaphase's family of reticulated products features a unique bypass design that eliminates cake-layer formation. Filtration occurs within the product. With a matrix of up to 85 percent porosity, CatTrap® technology maintains flow much longer than conventional solutions, while using reactor volume more efficiently. When randomly loaded into the unit, the sum of the effective internal porosity and external void space exceeds 90 percent, which lets you maximize your catalyst load utilization.

ActiPhase® technology features all these benefits and more, adding catalytic activity to reticulation. This family of products is extremely effective in situations where pressure drop and activity solutions are required simultaneously.



Over 90%

Internal porosity and external void space combined

## Crystaphase CatTrap Technology

Crystaphase CatTrap technology is specifically designed to provide the largest possible volume for trapping particle contaminants in any feedstock while maximizing lateral flow dispersion.

**Inert silica-alumina discs available in a variety of chemical compositions and sizes, offering significantly higher crush strength, increased resistance to attrition, and higher density.**

## Crystaphase ActiPhase Technology

Crystaphase ActiPhase technology takes purification one step further with active filtration, using catalytic activity to remove soluble compounds before they can poison the catalyst bed.

**Catalytically active discs available in a variety of chemical compositions and sizes, designed for problematic feeds, effective in eliminating diolefin and coke deposition, silicon and metal poisoning, and particle precipitation in high-TAN vacuum gas oil.**

## Advanced dispersion

Inside a reactor, uniformity is your best friend. Uneven fluid distribution results in catalyst coking, widening radial delta-T issues, and an artificial cap on your inlet temperature – particularly problematic in reactor beds of over 20 feet.

Our proven solutions improve flow distribution, which translates to longer cycles and greater yield. Preventing rivulets eliminates local hot spots, so you can optimize reaction without having to adjust temperature for problem zones.

"We have a 58,800 barrels per day gas oil hydrotreater, which would foul and require premature shutdowns for catalyst changes every six to nine months. For several years we tried everything: different grading schemes, deep bed filtration, a filtration tray with catalyst baskets. Nothing provided a cycle length longer than about 12 months. Finally, we discovered CatTrap from Crystaphase. They worked with us over the course of a few cycles, analyzing the foulant and adjusting their recommendations. Each cycle lasted longer than the previous one until they developed a scheme that allowed us to run 16 months without any increase in delta-P. The next cycle we added more CatTrap. We worked with our catalyst supplier and Crystaphase to make the catalyst deactivate in the same time frame, and were able to run for 20 months. CatTrap is absolutely the best material I have seen for handling foulants and extending cycle lengths. I would recommend this product to anyone dealing with short cycle lengths due to pressure drop."

– Principal Engineer, Major Gulf Coast Refinery


# Foulants, sharply in focus.

## The technology behind performance

We methodically analyze your current system's profile, then design customized and replicable solutions to clear your path to greater reactor performance.

Our laboratory is uniquely dedicated to the exhaustive analysis of foulants, which means we are focused on your problem, not our product. Our capabilities, which span from scanning electron microscopy to x-ray microtomography, can precisely identify the culprit, so that we can tailor a solution to eliminate it. We'll even come to you for an on-site consultation.

## Particle Size Analysis

Using laser diffraction, we can determine particle size distribution in a range of 0.1 to 3,500 microns (µm), allowing us to match a custom filtration solution specifically to the particles plaguing a reactor.

## Loss On Ignition (LOI)

We heat samples to about 500°C, burning off any residual sulfur or carbon, so that we can measure how corrosion and carbon/polymer deposition accelerate deposit formation.

## Inductively Coupled Plasma (ICP) Analysis

We can test for a large array of elements, reporting values as low as a few ppm, identifying particles contributing to pressure drop and poisons shortening catalyst life.

## Scanning Electron Microscopy (SEM)

At up to 1200x magnification, we can visually examine the shape of accumulated foulant particles for a clear picture of their role in diminished reactor performance. This provides us the ability to resolve particles and particle features as small as 1 µm. Understanding particle morphology helps identify filtration efficiencies and particle generation sources.

## Energy Dispersive X-ray Spectroscopy (EDS) Analysis

EDS identifies the chemical elements that make up foulant particles. Together with SEM imaging, it helps us determine their origin, trace their morphology under process conditions, and determine how they interfere with reactor performance.

## Digital Microscopy

This cutting-edge tool can resolve samples down to 1 µm with full depth of field, revealing performance-impairing particles for a life-like, high-acuity perspective on the formation of foulant deposits.

## X-ray Microtomography

This technology lets us see inside a sample and create a digital model of its structure, allowing us to evaluate the real-world performance of its filtration ability.

## Pressure-Drop Analysis

Combining engineering and scientific programming, our advanced proprietary instrumentation and techniques let us accurately predict CatTrap performance at different sizes and volumes.

## Reactor Filtration and Pressure-Drop Simulation

A suite of software designed and developed by our own engineers allows us to anticipate pressure-drop issues and model proposed or current solutions before the next cycle, instead of after it.

# A long-lasting reputation.

For over 25 years, Crystaphase has provided reactor solutions to hundreds of refining, petrochemical, and chemical plants worldwide. Like no other company, we understand the quantifiable variables that impede performance and have developed a systematic and replicable approach for removing those obstacles.

The result – longer production cycles, improved catalyst utilization, greater throughput, lower risk, and higher profits. The choice – crystal clear.

# Proven performance.

Used in thousands of applications, Crystaphase CatTrap technology has been adopted into the best practices of all the major oil companies and is by far the most effective solution on the market for particle filtration and poison control.

# A clear connection.

## Customer service

Your path to performance starts here and now. To begin, it's important that we have a complete understanding of what's happening inside your reactor. Contact our technical service team today to initiate a customized sample analysis of your system. Or if you have questions, just give us a call at +1 281-874-2110. We'd love to talk.

**24-hour Customer Support**

**Packaging & Delivery**

**Logistics & Coordination Support**

Crystaphase

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