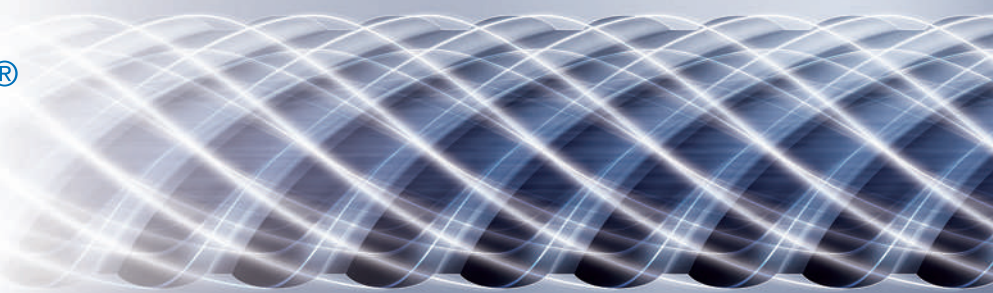


The logo consists of the letters 'S' and 'C' in a bold, white, sans-serif font, separated by a vertical line.

**SHAPE UP
THE HEART OF
YOUR PLANT**



SCOPE®



Schmidt + Clemens Group

This is S+C

Creativity and extensive knowledge are the ingredients with which innovations are made and innovation has always driven us.

Founded as a steel trading company in 1879, today S+C is a worldwide leading supplier of highly specialized high alloy products.

Over 1000 employees represent the independent family-run business at five production sites and three sales offices worldwide. With one of the most modern R&D departments in the industry and a high temperature test laboratory unlike any other in the world, S+C can develop metallic materials and the corresponding production processes for tailor-made tube systems.

Our centrifugal casting operations are located at various sites around the world, and nevertheless maintain uniform quality standards. This allows us to manage them as a network, which in turn enables us to turn even major orders around very quickly without compromising on quality.

Our offering is rounded out by a full range of services which, along with organization, disassembly and installation, also includes all logistics.

Welcome to Schmidt + Clemens

Page **4** SCOPE Fusion HTE

Maximum energy efficiency, longest maintenance intervals and minimum downtime for your plant

Page **6** Next generation of steam cracking tubing

With SCOPE Fusion HTE S+C achieved an unprecedented level in tube design and material

Page **8** How SCOPE Fusion HTE works

Page **10** Benefits of SCOPE Fusion HTE

Get an overview on all positive effects of SCOPE Fusion HTE for your steam cracking process



Welcome to the best!

SCOPE Fusion HTE – the steam cracker tubing of the future

The steam cracker is the heart of your ethylene and propylene production facility. Integrated into healthy supply and discharge lines, SCOPE Fusion HTE provides highly reliable and durable operation and ensures the maximum efficiency of your steam cracker. Repair and maintenance of the furnace itself or of directly adjacent peripherals, on the other hand, require costly shutdowns.

The inevitable formation of coke in a typical steam cracker environment is a complex phenomenon. Coke is deposited on the surface of the centrifugally cast tubes where it reduces the effective cross-sectional area while adding undesirable thermal insulation. The furnace is at risk of suffering a heart attack.

In order to maintain the desired cracking efficiency, however, the required furnace temperature can be increased for a while longer – although this requires considerable additional energy. But sooner or later, the plant reaches the point where it has to be shut down so that the radiant coil can be decoked.

It's a never-ending cycle with which you, as a plant operator, are all too familiar. Based on decades of experience, extensive research and exhaustive testing, S+C continuously optimizes its product range. Our objective is to achieve maximum energy efficiency, the longest possible maintenance intervals, and minimum downtime for your plant.

**With SCOPE Fusion HTE,
we have achieved a breakthrough
to a whole new level.**

It combines the high quality alloy HT E, which has proven effective for more than a decade now, with a mechanically created 3D tube design, which both effectively slows the coke deposition process and optimizes the cracking of the feedstock in the steam cracker.

And it lets the heart of your plant continue to beat strongly for a long, long time.

“The SCOPE design is superior to all bare and profile tubes in terms of efficiency and selectivity, but the alloy Centralloy® HT E makes SCOPE Fusion HTE the best profile tube in the world!”

Dr. Dietlinde Jakobi



Strengthen the heart
of your plant



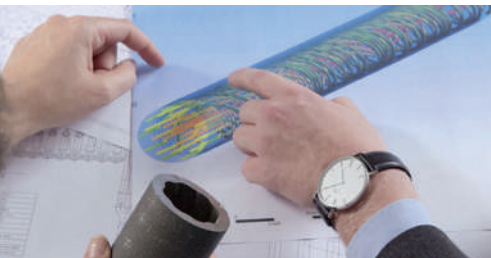
SCOPE Fusion HTE – intelligent profile meets superior material

The use of an intelligent profile in steam cracker tubes can considerably raise the selectivity of a plant. Use of the right alloy as tube material can greatly inhibit coking and carburization processes.

But what happens when innovative tube design meets a perfect material? SCOPE Fusion HTE is earning top marks for performance and endurance and has distinguished itself as by far the best of today's steam cracker tube systems.

The use of HT E – which has a proven track record as the most effective alloy to inhibit coking and carburization – extends required decoking intervals by up to ten fold, thereby minimizing downtime while also protecting the plant. The innovative 3D design, which can be adapted to meet customer-specific requirements, increases selectivity and ethylene yield while saving energy at the same time.

SCOPE Fusion HTE helps you get the most out of your steam cracker!



SCOPE Fusion HTE is the right choice for many reasons

The design goals for the SCOPE Fusion HTE tube – an entirely new development – were particularly extensive, because they specifically aimed to avoid the known shortcomings of existing profile tubes. The objective was to achieve the highest possible plant availability while optimizing the energy efficiency of a steam cracker equipped with the SCOPE Fusion HTE tube at the same time.

For example in combination with significantly increased selectivity and improved ethylene yield, the benefits add up to a fast return on investment for the operator. It is the unique combination of the proven HT E alloy with the innovative SCOPE profile which leads to some truly extraordinary results.

Up to ten times longer production runs!

During operation, the centrifugally cast material together with the unique profile of the SCOPE Fusion HTE tube facilitate a relatively low material temperature which, moreover, is distributed uniformly across the tube shell. In combination with the exceptionally strong HT E material, both coking and carburization of the steel is greatly inhibited.

The convenient result: less downtime, less frequent maintenance, lower maintenance costs, less wear and tear on the plant – and up to ten times longer production runs.

Centrifugally cast tubes rather than forged tubes

S+C looks back on decades of experience in the production of centrifugally cast tubes. This material has properties that make it particularly suitable for use in steam crackers.

In combination with the unique SCOPE design, it provides for better heat transfer, lower tube metal temperatures, and more uniform gas temperature distribution than with conventional tubes, as well as an optimal pressure drop within the tubes.

A vertical, close-up photograph of a SCOPE Fusion HTE tube. The tube is dark grey and has a complex, woven internal profile that is highlighted in a lighter, almost white color. The profile consists of multiple overlapping, curved lines that create a diamond-like or lattice-like structure. The tube is shown in a perspective view, with the top and bottom edges visible.

Internal Profiles for maximum results

Profile Tube technological "Leap forward"

Both the profile itself – which can be individually tailored to meet requirements inside the unit – and the mechanical production process for SCOPE Fusion HTE tubes were developed from radical innovative new thinking and technology and offer clear advantages over other tubes on the market. The SCOPE profile is designed to achieve the target temperature inside the tube faster and to distribute it more uniformly, which has a positive effect on both the selectivity and the yield.

This is the only tube that combines the innovative SCOPE profile with the proven Centralloy® HT E material. It forms an extremely stable protective layer on the inner wall of the tube and acts against catalytic coke formation as well as carburization of the tube material.

Controlled flow, minimized pressure drop

The SCOPE Fusion HTE tube optimizes heat transfer from the outer surface of the tube into the gas stream and improves the flow dynamics of the gas stream, which is controlled by a specifically designed radial swirl flow.

SCOPE Fusion HTE increases selectivity and ethylene yield

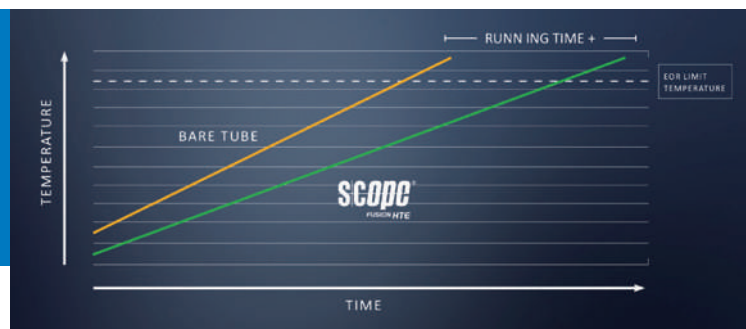
Measurements have shown that the simultaneous combination of high heat transfer and a balanced gas temperature inside the tube results in significantly higher product selectivity. Together with the higher flow rate in the SCOPE Fusion HTE tube and the greatly extended decoking intervals, this provides major cost benefits.

SCOPE Fusion HTE: Full service

As a SCOPE Fusion HTE customer, you reap the benefit not only from the unique technical advantages of this innovative tube system, but also from our S+C service management.

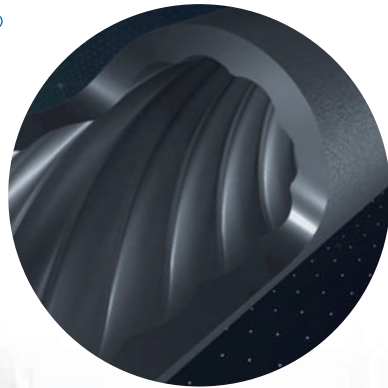
First, we prepare an exact specification profile for the tubes used in your plant – on request, we provide you with on-site support during operation, in order to get a complete picture. Your tubes will then be designed to meet your precise requirements and custom built for you. Here you can rely on both the optimal metallurgical characteristics and the precise manufacturing of your centrifugally cast tubes.

Operating Temperature Window–SCOPE Fusion HTE vs. Bare Tubes (schematic graph)

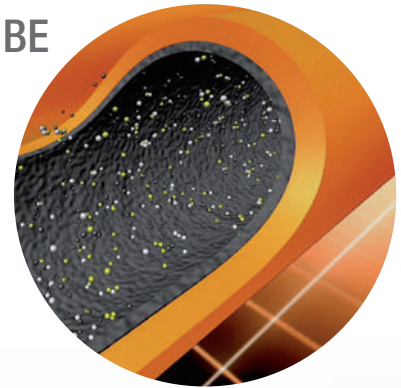


Longer Runs – Lower Coking Rates

scope[®]
FUSION HTE



BARE TUBE



Made by S+C is
a guarantee for top quality





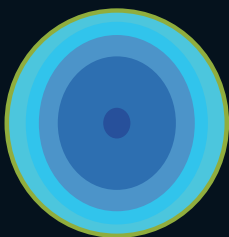
SCOPE Fusion HTE – the benefits for your steam cracker at a glance

Longer runs, less decoking

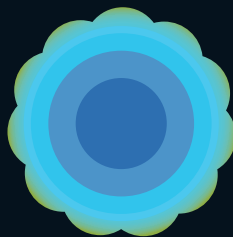
- Lower tube wall temperatures
- Balanced temperature profiles (cross-section / circumference)
- Minimized temperature variations between the “peaks” and “troughs” within the tube
- Shorter residence time of cracking gas at the tube wall

Increased productivity

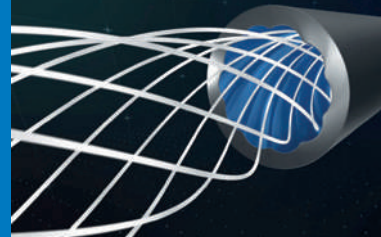
- Sustained improvement in heat transfer
- Better distribution of heat over the entire tube cross-section
- Minimized temperature variations between the “sunny” and “shady” areas within the tube
- Higher selectivity than with bare tubes
- Higher operating profit



Cross-sectional temperature profile: bare tube



Cross-sectional temperature profile: SCOPE Tube



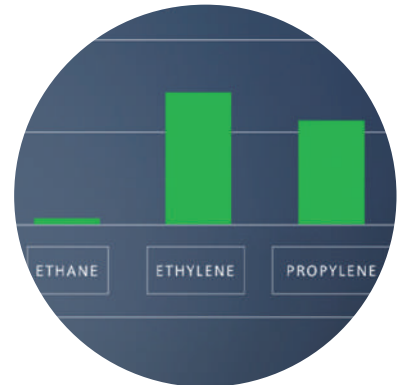
Fluid Pathline SCOPE

Positive effects on your cracking process

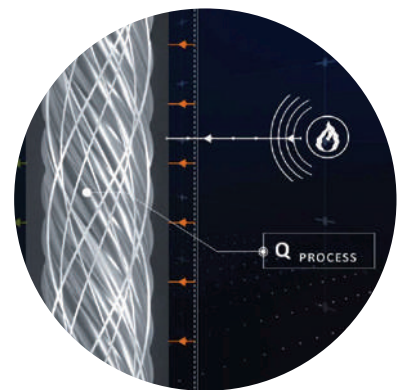


BENEFITS

- Rotating feed flow
- Lower material temperature
- Optimized heat transfer
- Less coking
- Uniform temperature distribution across the tube shell
- Less carburization



Increased selectivity and higher ethylene yield



Optimized energy efficiency of the entire furnace

Count on our expertise

Schmidt + Clemens was included in the “Lexicon of German World Market Leaders” for the first time in 2015, while the leading weekly business magazine “WirtschaftsWoche” listed us in their ranking of the “Top 100 Small and Medium-sized German Companies.”

In 2016, “TOP 100” – the only economically supported benchmarking for innovation management in Germany – awarded us the title “Top Innovator of 2016” as one of the most innovative of all small and medium-sized German companies. The study examined the company’s innovation management and innovation success.

The TOP 100 are the pacesetters in their respective industries. And the findings from the study bear this out: The companies include 97 national market leaders and 32 world market leaders.

We’re pleased to receive this recognition, because it confirms that we approach our work with passion and dedication.





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How can we support you?

With its "Installation Service" activities, Schmidt + Clemens is equipped and ready for even the most demanding challenges. Try us and find out for yourself just how supportive, cost-effective and reliable cooperation can be.

You will be convinced of the value of our services.

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