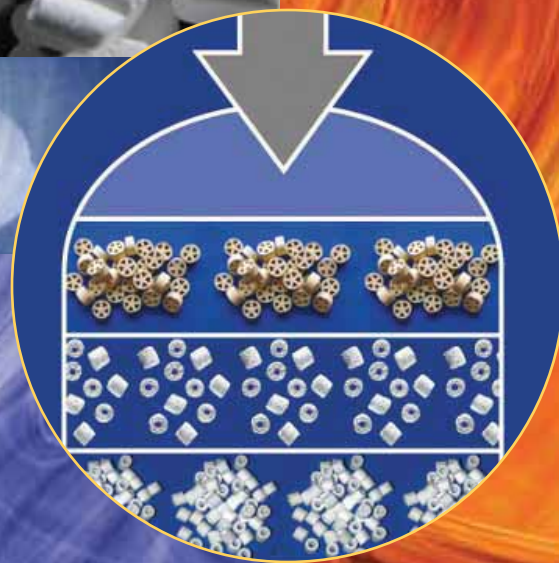


Saint-Gobain NorPro Catalytic Products

*Innovative and Optimal
Proprietary Catalyst Carriers*



Saint-Gobain NorPro Catalytic Products

Saint-Gobain NorPro is the world's leading supplier of merchant catalyst carriers. Applying the more than 60 years of experience we have gained co-developing carriers with catalyst clients, we custom engineer the physical and chemical properties of a variety of materials and shapes to provide the optimal proprietary carrier for each customer-specific need.



Co-Development Cycle – The Key to Rapid Innovation

The Client Develops the Catalyst; We Develop the Carrier

1 Saint-Gobain NorPro Capabilities

- Presentation of Saint-Gobain NorPro capabilities
- Analysis of the client's requirements
- R&D plans proposed
- Secrecy agreements signed

2 Research and Development

- Samples produced at the laboratory scale to establish the formulation (1-20 kg)
- Several rounds of sample testing and reformulation occur
- Raw materials checked for availability and consistency
- Optimum manufacturing techniques selected; manufacturing personnel are involved from the start

3 Scale-up

- The Stow semi-works facility is used to scale up to >100 kg, thus eliminating factory scale-up problems
- Final calcination in the full-scale manufacturing facility
- Preliminary specifications are developed
- Size and shape are optimized

6 The Next Generation

- The next step change in performance is initiated by the joint team

Our Customer

5 Improvement

- The production process is closely monitored by R&D engineers, who can then suggest ways to improve quality
- The client monitors catalyst performance with the same goal
- Regular meetings between Saint-Gobain NorPro and the client facilitate implementation of continuous improvements

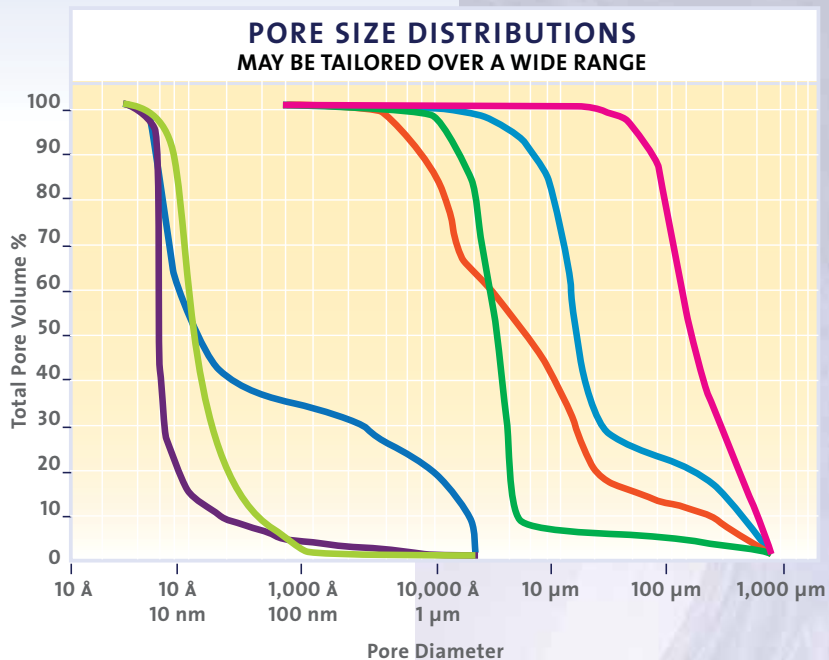
4 Production

- Longer production runs enable specifications to be finalized
- Predictive modeling is used to adjust production processes to compensate for raw material and other variations
- ISO 9000 procedures ensure complete control of manufacturing process
- Rigid quality assurance verifies required product quality

Tailored Porosity Design

Putting in the Pores

The diagram indicates the wide range of pore sizes that may be incorporated into NorPro® carriers. Note especially the ability to make materials with bimodal and trimodal pore size distributions that allow a carrier to be tailored to the exact requirements of a particular reaction.



The products described in the Typical Properties insert represent only some of the extensive capabilities offered by Saint-Gobain NorPro. We make carriers with widely varying physical and chemical properties. If you don't see your exact requirement, contact us for more information.

Saint-Gobain NorPro has long experience in the development and commercialization of carriers in a wide range of materials.

Very close control of calcination conditions is required to produce high phase purity materials such as theta-, chi- and delta-aluminas. Titanias and zirconias are not only high purity, with no other binder materials, but also may be phase controlled – anatase and rutile titanias and monoclinic and tetragonal zirconias. Silica carriers have tightly controlled soda and alumina content.

Silica-aluminas may show very high surface areas, while silicon carbide carriers offer exceptional thermal conductivity characteristics. Many mixed oxide materials have been developed as well.

A wide range of shaped carriers can be manufactured using extrusion and pressing techniques. Very low attrition spray dried carriers have been developed and are commercialized in Saint-Gobain NorPro's Canton, Ohio facility. A unique forming mechanism can produce highly monosized UniSpheres™.





Compagnie de Saint-Gobain is a materials company with a distinguished history. It was founded more than 300 years ago and has since flourished as one of the world's top industrial corporations, with the single purpose of serving the customer through a commitment to quality and leadership. Saint-Gobain operates in more than 50 countries, employing over 200,000 people in five major business sectors: Flat Glass, Packaging, Construction Products, Building Distribution and High-Performance Materials. Saint-Gobain NorPro is represented within the High-Performance Materials sector.

Compagnie de Saint-Gobain

Materials Transformed

Saint-Gobain operates as a designer, manufacturer and distributor of functional materials addressing the needs of industrial and trade clients. A firm commitment to technology development, quality and leadership has enabled Saint-Gobain to maintain its leading position in a wide variety of markets.

Saint-Gobain's High-Performance Materials Sector harnesses advanced technology and materials platforms to provide high value-added solutions for demanding industrial applications. It has operations in abrasives, plastics and ceramics. The production system comprises over 250 plants in 35 countries. An emphasis on materials engineering enables the company to take a leading position in a wide range of markets.

The High-Performance Materials Sector includes the following businesses:

- Saint-Gobain Abrasives
- Saint-Gobain Ceramics
- Saint-Gobain Crystals
- Saint-Gobain Grains & Powders
- Saint-Gobain Performance Plastics
- Saint-Gobain Composites
- Saint-Gobain Technical Fabrics
- Saint-Gobain Vetrotex

www.OilandGas.saint-gobain.com

Saint-Gobain is very active in all sectors of the oil and gas industry – from production, through refining, to chemicals and petrochemicals. Visit the website listed above for more information.



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Saint-Gobain NorPro is active in other areas:

Refinery Products are specially designed to solve problems in oil refineries:

- Highly macroporous **MacroTrap® media** alleviates pressure drop in beds of catalysts and absorbents.
- **Denstone®**, the world's leading range of ceramic bed support media, including a new shape – Denstone® deltaP™.
- Low pressure drop **Ceramic Pentarings** as bed topping media.

Process Ceramics co-develops tailored non-porous ceramics in special shapes, such as **HexPak™** media for use as thermal management media (especially in regenerative thermal oxidizers – RTOs) and mass transfer media under the **Norton™ Proware™** name.

The wide range of ceramic **Proppants** is used in oil and gas production worldwide.

The information herein does not constitute a guarantee or warranty. The Saint-Gobain NorPro warranty is set forth in its standard terms and conditions which govern sales of Saint-Gobain NorPro products. The standard terms are set forth in Saint-Gobain NorPro quotations and acknowledgements and are also available on request.