with support of: FLANDERS INNOVATION & ENTREPRENEURSHIP Flanders State of the Art

Game-changing catalytic dewaxing: Zeopore reaches 30°C cloud point improvement while keeping diesel yield loss under 2wt%, confirmed in a high throughput testing campaign at hte GmbH.

Leuven (Belgium) - June 30, 2021 - Making diesel winter-proof is currently an expensive process as refiners face high diesel yield losses or have to turn to expensive additives or kerosene blending. hte GmbH examined the catalytic dewaxing performance of Zeopore's proprietary zeolite mesoporization technology in its high throughput testing facility using industrial feeds and process conditions.

The results are phenomenal: Zeopore reaches 5 times lower diesel yield loss at high cloud point or pour point improvements, compared to an industrial reference zeolite. Zeopore reaches a 30°C cloud point improvement while keeping diesel yield loss well below 2wt%. Furthermore, Zeopore's catalytic dewaxing innovation reduces capacity-limiting gas formation, improves product slate composition, and maintains favorable zeolite activities and lifetimes.

Zeopore's unique tunable mesoporization technology is economically attractive for catalyst manufacturers and refiners, even more in sustainable processes delivering renewable fuels.

Economic dewaxing of diesel and lubricants is challenging

Paraffinic components in standard diesel feedstocks tend to crystallize when temperatures drop below 10 degrees Celsius. The so-called cloud point (CP) is the threshold temperature where a specific fuel starts to become waxy, opaque and less liquid. Dewaxing of diesel and lubricants is necessary for usage in colder operating environments, or during winter periods. Dewaxed products ensure the optimal performance, reduced emissions and prevent malfunction or damage to diesel engines and other machinery. Typically, the aim of dewaxing is to reduce the CP with 30 degrees or even more in arctic environments. As diesels and lubes from renewable sources typically have less favorable cold flow properties, they face an even higher need for dewaxing.

Qualitative dewaxing is a challenging process because it often results in undesired cracking of molecules, which leads to expensive diesel yield loss or undesired gaseous streams. Alternatives for reducing CP include the use of additives or blending with (valuable) other finished products, both expensive routes and offering no flexibility in managing opportunity crudes. From an economic standpoint, the preferred approach is catalytic dewaxing, which is in essence hydro-isomerization or branching of linear paraffinic components to form branched components with better cold flow properties. A critical condition here is to keep the economics of this conversion under control, especially minimizing the diesel yield loss to lighter fractions.

Zeopore optimizes zeolite catalyst mesoporization for dewaxing

The narrow micropore structure of today's isomerization-selective zeolite catalysts forms the highest industry standard of dewaxing improvement based on a stable and tunable cloud point improvement. Nevertheless, the zeolite’s narrow micropores also provoke access and diffusion limitations, resulting in undesired side reactions and unwanted products, such as

over-cracked molecules in the case of dewaxing. Zeopore adds a secondary level of larger mesopores to conventional zeolites to increase their catalytic efficiency by improving access to the active sites located in the zeolites' micropores. Zeopore's innovative mesoporization processes, specifically designed to maximize mesopore formation quality and efficiency, only requires standard unit operations and low-cost ingredients.

Kurt Du Mong, CEO of Zeopore Technologies: "Over the past three years, Zeopore has developed a broad technology toolbox to cost-effectively generate more performant zeolites with custom-made properties. Compared to the reference parent zeolite, Zeopore succeeded in tripling the mesoporosity and optimizing the metal addition of a commercial dewaxing zeolite without compromising its powerful intrinsic properties and stability. We are proud to have demonstrated the catalytic and economic value proposition in the highly relevant dewaxing application. Zeopore is currently negotiating with selected catalyst manufacturers to bring this technology to market."

The innovative dewaxing zeolites developed by Zeopore are ideally suited for catalytic dewaxing of fossil derived diesels and lubricants, representing two major global markets. Next to that, the emerging markets of renewable fuels and lubricants are growing extremely fast and of high interest to the industry. Dewaxing in this market is imperative because these renewable products have lower cold flow properties than those of fossil-based products. Higher-performance dewaxing at an affordable cost is even more important in light of delivering high-quality renewable fuels.

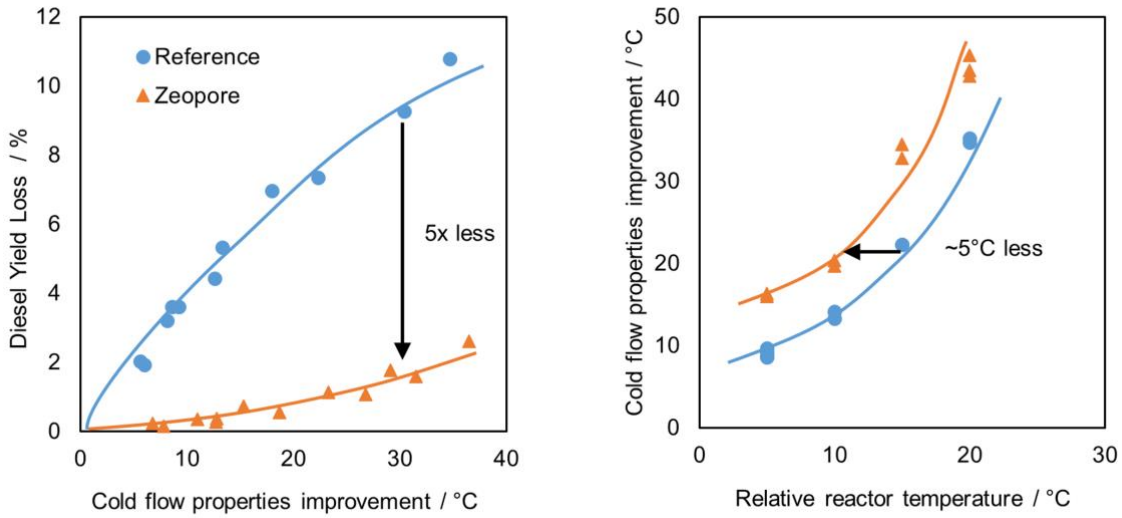
Zeopore's catalytic dewaxing breakthrough is industrially viable

To convince the global dewaxing industry, Zeopore has tested a noble-metal containing unidirectional mesoporized dewaxing zeolite in a parallel state-of-the-art 16-fold high-throughput testing unit at hte GmbH in Heidelberg, Germany. The test has been conducted in broad ranges of industrially-relevant pressures, temperature and space velocities.

The results demonstrate a real breakthrough in catalytic dewaxing. The graph below shows that at fixed CP improvement, e.g. when considering a gain of 30 degrees Celsius, the mesoporized Zeopore dewaxing zeolite enables a 5-fold lower diesel yield, arriving at **a diesel loss below 0.06wt% per degree of CP improvement**. This achievement is unseen in the catalytic dewaxing industry. In particular because Zeopore is able to couple the benefits of its high-performance zeolites with a low-cost and tunable manufacturing process.

	Feed	Reference	Zeopore
Cloud point / °C	-5	-35	
Diesel fraction / wt%	93.8	84.6	92.0
LPG formed / wt%	-	3.2	0.6

with support of: FLANDERS INNOVATION & ENTREPRENEURSHIP Flanders State of the Art

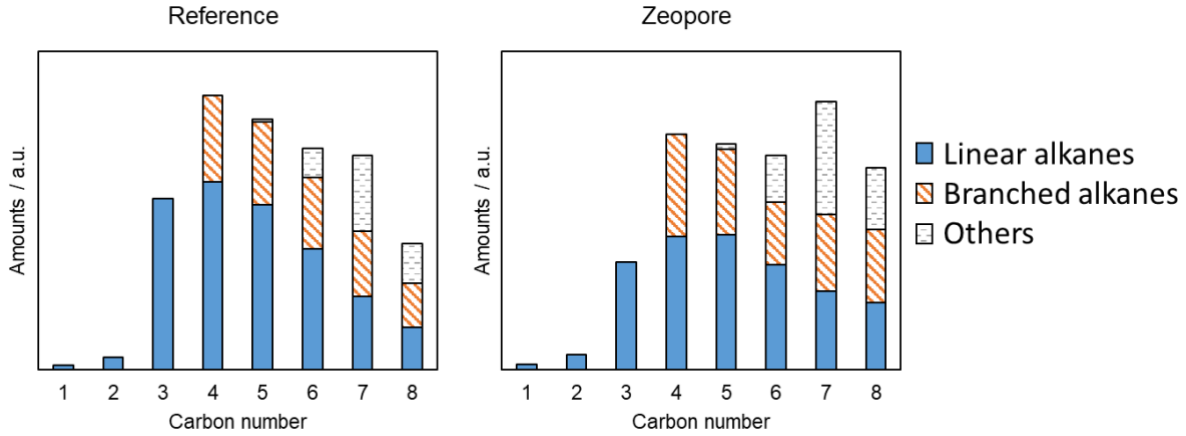


Zeopore zeolite selectivity and activity versus reference (parent)

Wolfram Stichert, CEO of hte GmbH in Heidelberg, Germany: "We are very pleased that Zeopore has selected hte as testing partner, and that we have been able to contribute to the success of this project with our R&D expertise in this area and our state-of-the-art high throughput technology. hte is glad to have assisted in achieving this milestone, which is a stepstone in Zeopore's further commercialization in the coming years."

The test results further show that the observed zeolite dewaxing catalyst does not suffer increased degradation compared to the parent zeolite. In addition, the use of Zeopore's dewaxing catalyst resulted in much lower gas (LPG) formation (see table above). This eliminates the typical capacity reductions in catalyst production faced by catalyst manufacturers and refiners due to excessive gas formation.

Moreover, even when evaluated at a fixed diesel loss, Zeopore's dewaxing zeolite offers additional advantages: below you find the product slate composition of the lighter fractions, demonstrating a lower degree of gas make, and a more beneficial amount of branched and larger molecules.



Product slate C1-C8 at fixed diesel loss

Using its innovative tunable toolbox, Zeopore develops mesoporized zeolites for a wide range of applications covering refining, petrochemical, biomass conversion and plastics recycling. These mesoporized zeolites are available through license or product supply agreements.

The achievements mentioned in this press release have been made possible with the support of Flanders Innovation & Entrepreneurship (VLAIO).

About Zeopore Technologies

Zeopore targets global leadership in developing and commercializing mesoporous zeolite catalysts for refining, petrochemistry, biomass conversion and plastics recycling. Zeopore has created a unique technology platform to cost-effectively make more performant zeolites with custom-made properties. Our technologies are applicable to any commercially relevant zeolite, broadly tunable to desired zeolitic properties, retain intrinsic zeolitic properties, and increase the process economics and scalability.

Next to a larger output of desired products, Zeopore's technology platform leads to higher product quality, lower energy use, and less waste for several catalytic processes. The mesoporization technologies of Zeopore offer catalyst manufacturers up to 10-fold cost advantage compared to competing technologies. As a technology development company, Zeopore focuses on collaborations (license or product supply agreements) with innovative catalyst suppliers in the world.

Contact information

Zeopore Technologies NV
Interleuvenlaan 23
3001 Leuven
Belgium
www.zeopore.com

Communication contact person
Rob Snoeijs, MSc
Communications
Phone: +32 499 331414
Email: rob.snoeijs@zeopore.com