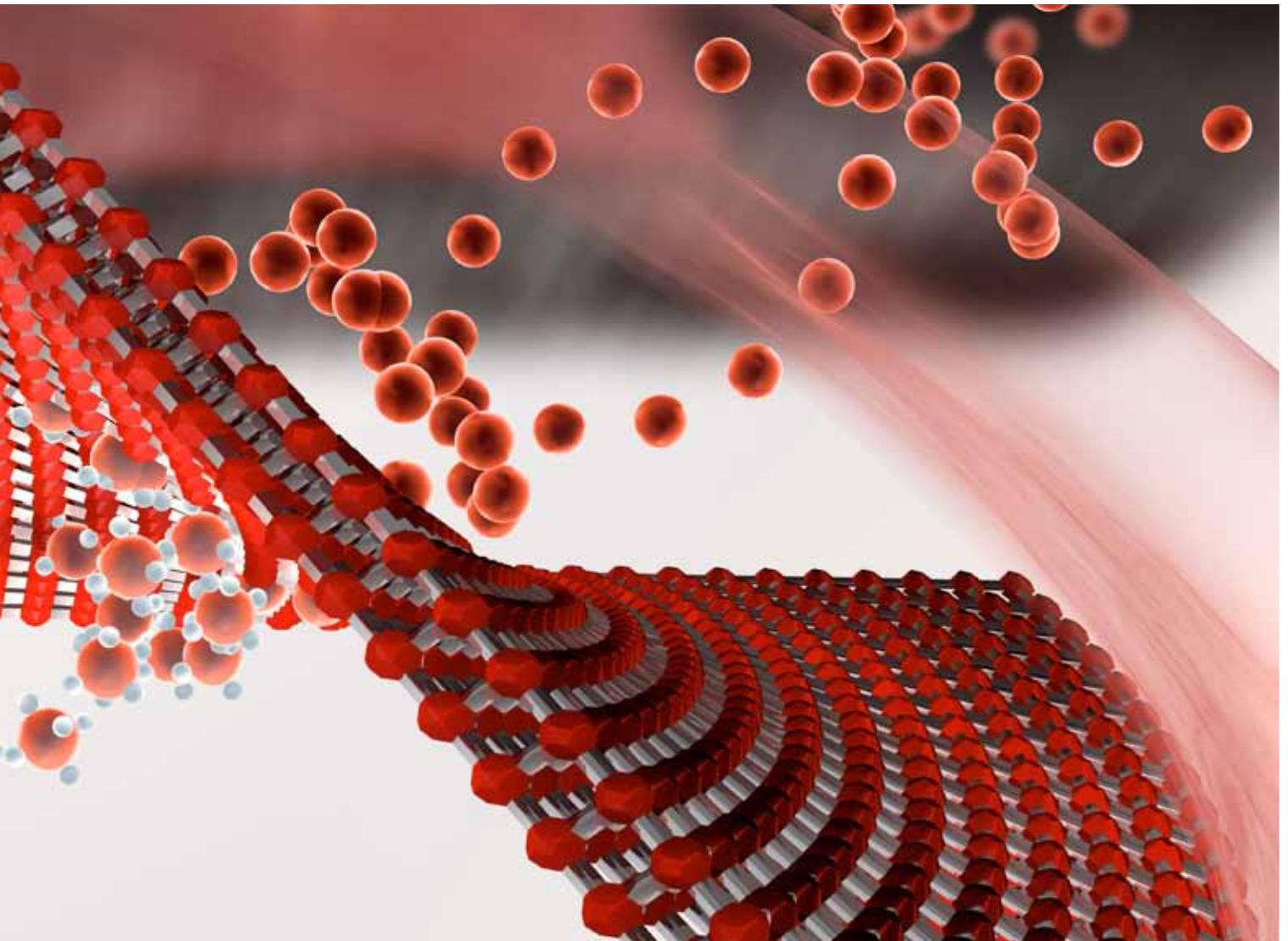


Adsorption Technologies: our work – our life – our passion.

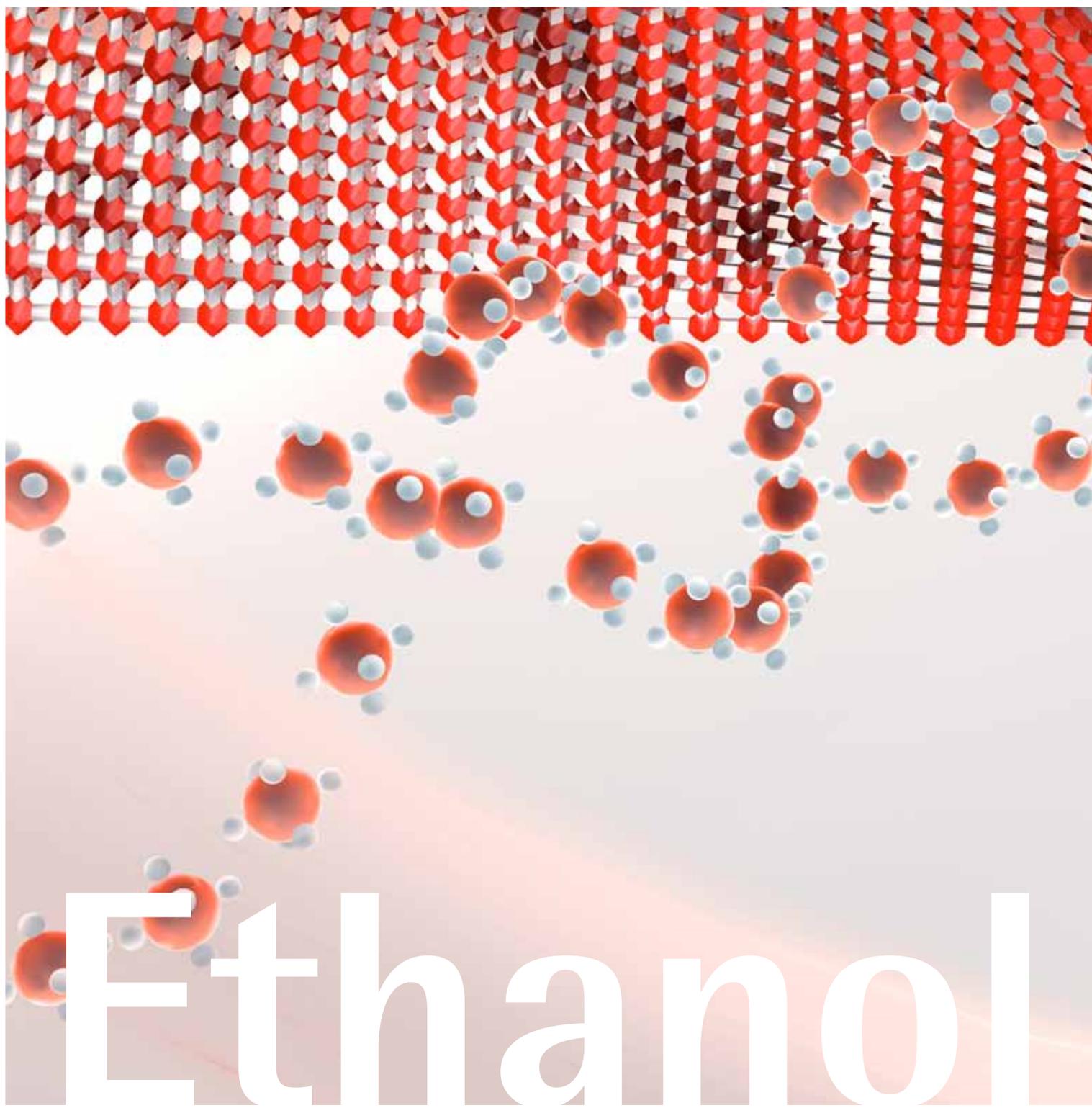
ZEOCHEM®

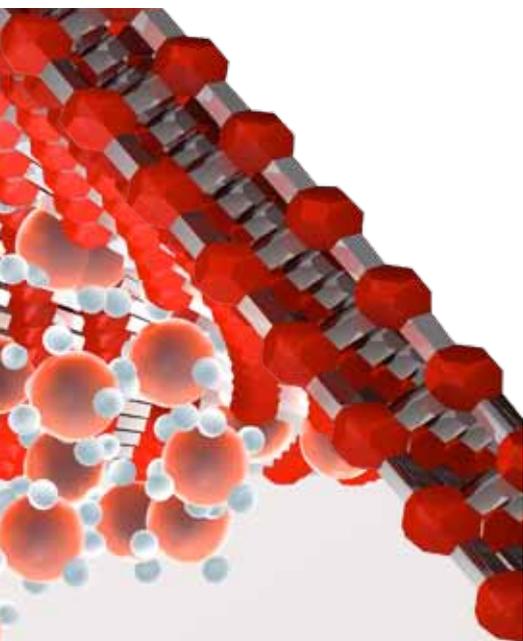


## Molecular Sieve Adsorbents for Ethanol Processing



Zeochem Products for the Ethanol Processing Industry





# ZEOCHEM® Z3-03 for Ethanol Dehydration

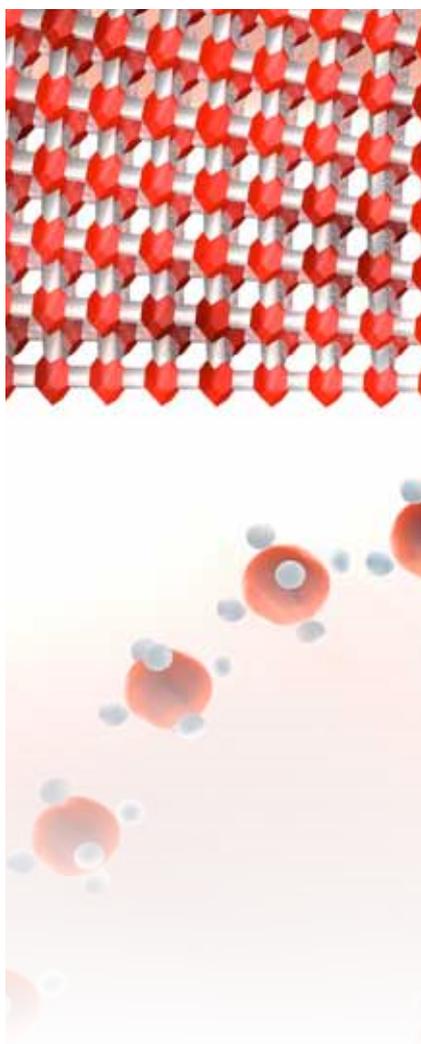
Zeochem, a manufacturer of high quality molecular sieves and chromatography gels, was established more than 190 years ago and its headquarters is still based at the original location on Lake Zurich, Switzerland. Zeochem is a subsidiary of the Swiss CPH Chemie+Papier Holding AG.

With manufacturing facilities in Uetikon, Switzerland and Louisville, KY, USA, Zeochem provides coordinated global supply and support to all molecular sieve adsorbent markets. This is particularly important today with complex plant requirements and services needed worldwide.

Zeochem is a world leader in supplying molecular sieves for the ethanol dehydration market. Over 70% of the ethanol plants in the USA and Brazil have been supplied with our ZEOCHEM® Z3-03 molecular sieve. Through the years and through our process of continuous improvements, ZEOCHEM® Z3-03 continues to be the performance standard for molecular sieves in ethanol dehydration.



## High Quality Manufacturing



ZEOCHEM® Z3-03 is the potassium form of the A type zeolite structure and has an effective pore opening of 3 angstroms (0.32 nm). This molecular sieve is designed for high water content in the feed stream, elevated temperatures, and quick cycling – all factors inherent in the ethanol drying processes. Zeochem's proprietary manufacturing process provides the adsorbent superior strength and long service life, avoiding costly sieve change outs and the resulting downtime.

### Advantages

#### 1. EXCELLENT MECHANICAL PROPERTIES – BEAD CRUSH STRENGTH AND ATTRITION

ZEOCHEM® Z3-03's bead crush strength and attrition properties are among the best in the industry.

The spherical shape of the product ensures that all physical forces applied are compressive in nature. Molecular sieve adsorbents are much stronger under compressive forces as compared to the tensile forces acting on extruded (rod or pellet) shapes.

The smooth, hard outer surface resists attrition which leads to dust formation and bead weakening. As a result, the product as packaged contains very low dust and generates very little dust during loading. In addition, the Zeochem manufacturing process minimizes the internal stresses within the particle itself.

In strength retention tests against competitive adsorbents, the result was as follows:

- ZEOCHEM® Z3-03 had a 35% greater dry crush strength value
- ZEOCHEM® Z3-03 maintained a 23% greater crush strength after cycling

### Typical Properties

Property	British Unit	Value		Metric Unit	Value	
Tapped Bulk Density	lb/ft <sup>3</sup>	46		kg/m <sup>3</sup>	735	
Bead Mesh Size, Nominal	mesh	8 x 12	4 x 8	mm	8 x 12	4 x 8
Bead Diameter, Nominal	inch	1/16	1/8	mm	1.6 – 2.6	2.5 – 5.0
Crush Strength	lb	10	20	N	90	
Equilibrium Water Adsorption Capacity, @21 °C and 53%rh	weight %	21		weight %	21	
Residual Water Content, 550 °C as shipped	weight %	< 1.0		weight %	< 1.0	
Heat of Adsorption	BTU/lb H <sub>2</sub> O	1,800		kJ/kg H <sub>2</sub> O	4,200	
Specific Heat	BTU/lb°F	0.23		kJ/kg°C	1.07	

- ZEOCHEM® Z3-03 suffered only a 0.6% breakup after cycling, compared to a 4.2% loss for the competitive adsorbent (a factor of 7:1)

## 2. PHYSICAL INTEGRITY

The high feed water content in ethanol drying causes fast rates of water adsorption and a resulting fast temperature rise in the adsorbent bed, all of which can be detrimental to the physical integrity of the sieve. ZEOCHEM® Z3-03 is designed to withstand these extreme conditions and test results show low particle breakup over the range of operating temperatures.

## 3. LONG LIFE

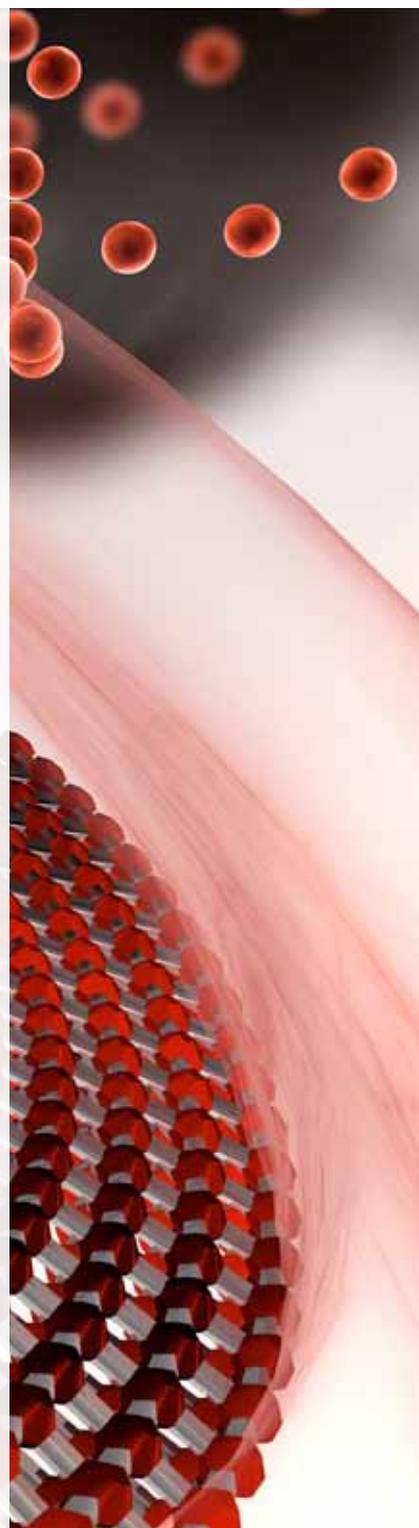
High feed water contents also require quicker operating cycles than experienced in other services. ZEOCHEM® Z3-03 maintains its capacity and stability over hundreds of thousands of operating cycles. In addition, ZEOCHEM® Z3-03's three angstrom pore openings allow only water molecules to be adsorbed, reducing co-adsorption of ethanol, sieve coking, and carbon deposition which shortens the adsorbent's life.

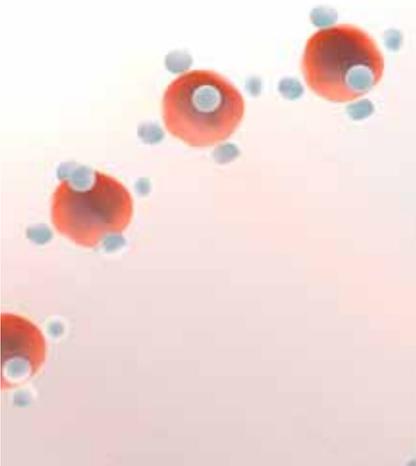
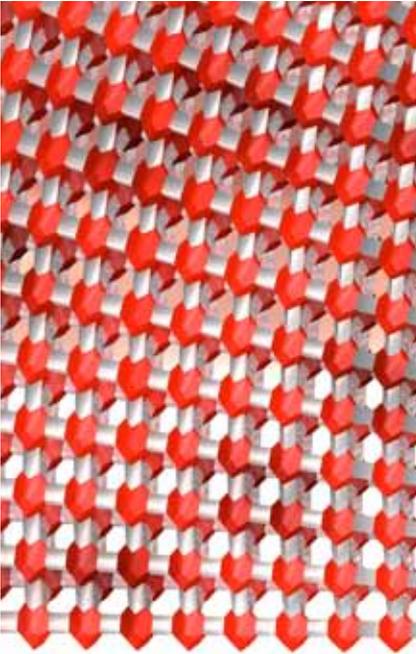
## 4. BETTER FLOW DISTRIBUTION

ZEOCHEM® Z3-03's high particle density and narrow bead size distribution result in high volumetric efficiency and superior mass transfer characteristics.

## 5. LOW PRESSURE DROP

The spherical shape and smoothness of ZEOCHEM® Z3-03 beads provide a lower pressure drop than other adsorbents. This low, stable pressure drop allows higher throughputs and also contributes to ZEOCHEM® Z3-03's minimal product breakup and superior attrition resistance.



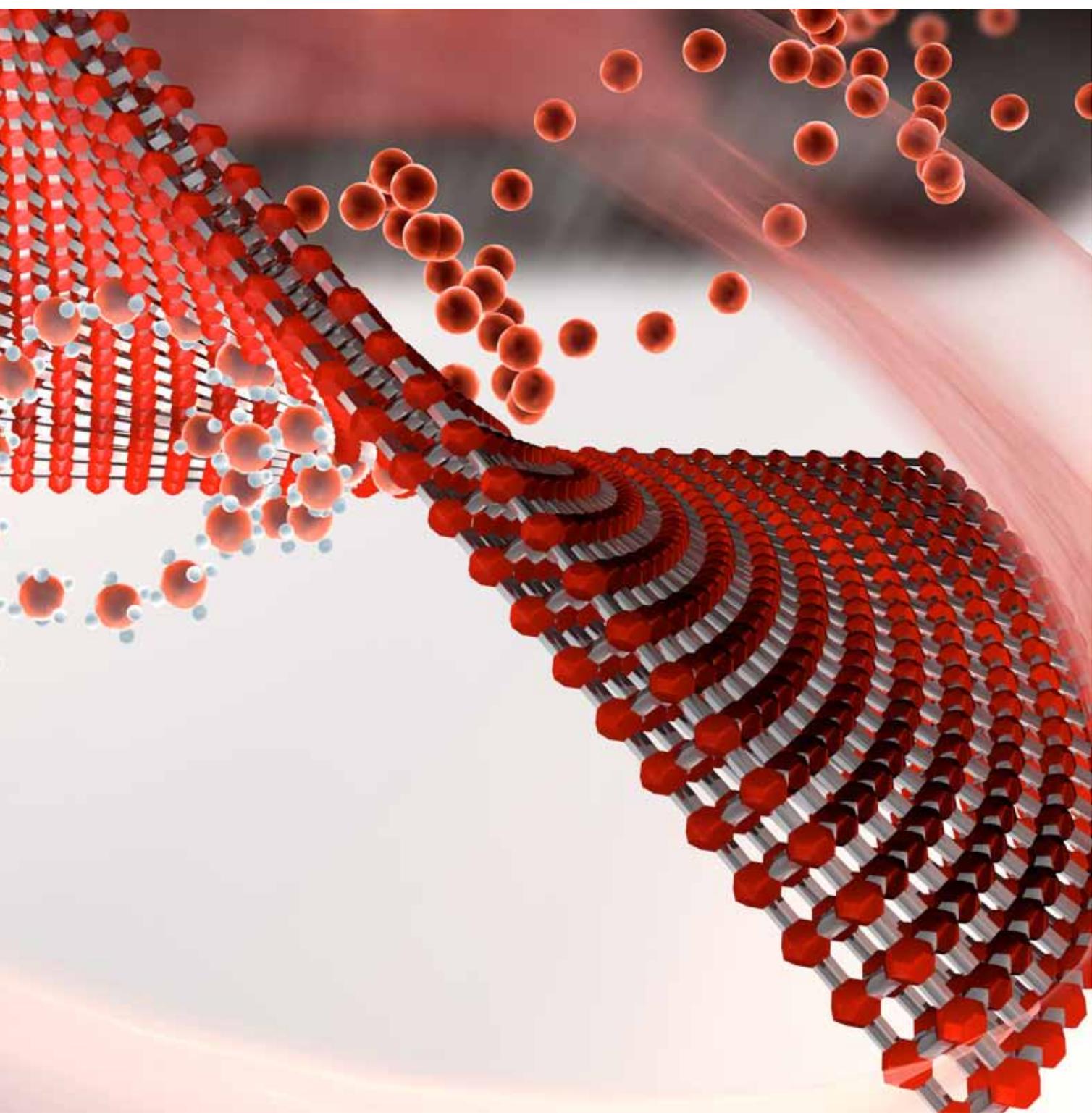


# Technical Support

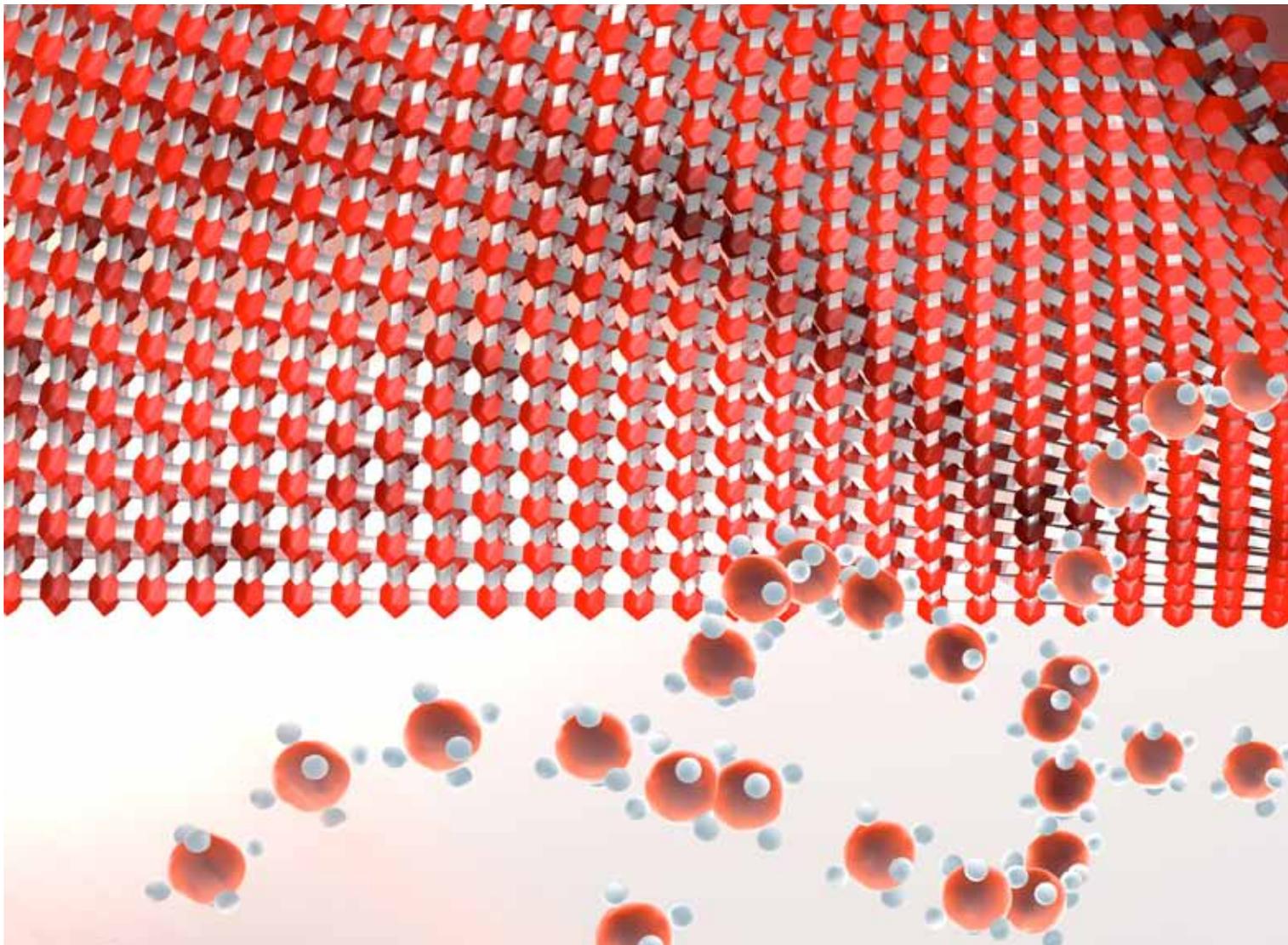
Our Technical Service engineers have been involved in supporting ethanol plants around the world and in plants with many different designs and process conditions. This exposure has given Zeochem the data and experience necessary to offer unequalled technical support. Zeochem can evaluate each situation and make design and operating recommendations specific to each plant's needs. Engineering services available to our customers include process simulation capabilities, on-site trouble shooting, optimization, and training programs.

Optimization of an ethanol plant's molecular sieve beds can be critical to meeting economic and production objectives in today's ethanol market. To help meet that need, Zeochem offers optimization services that can result in increased ethanol production and significant cost savings for the producer. Zeochem also offers sample testing services to help evaluate the condition of the molecular sieve and determine the remaining life on the installed beads.





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