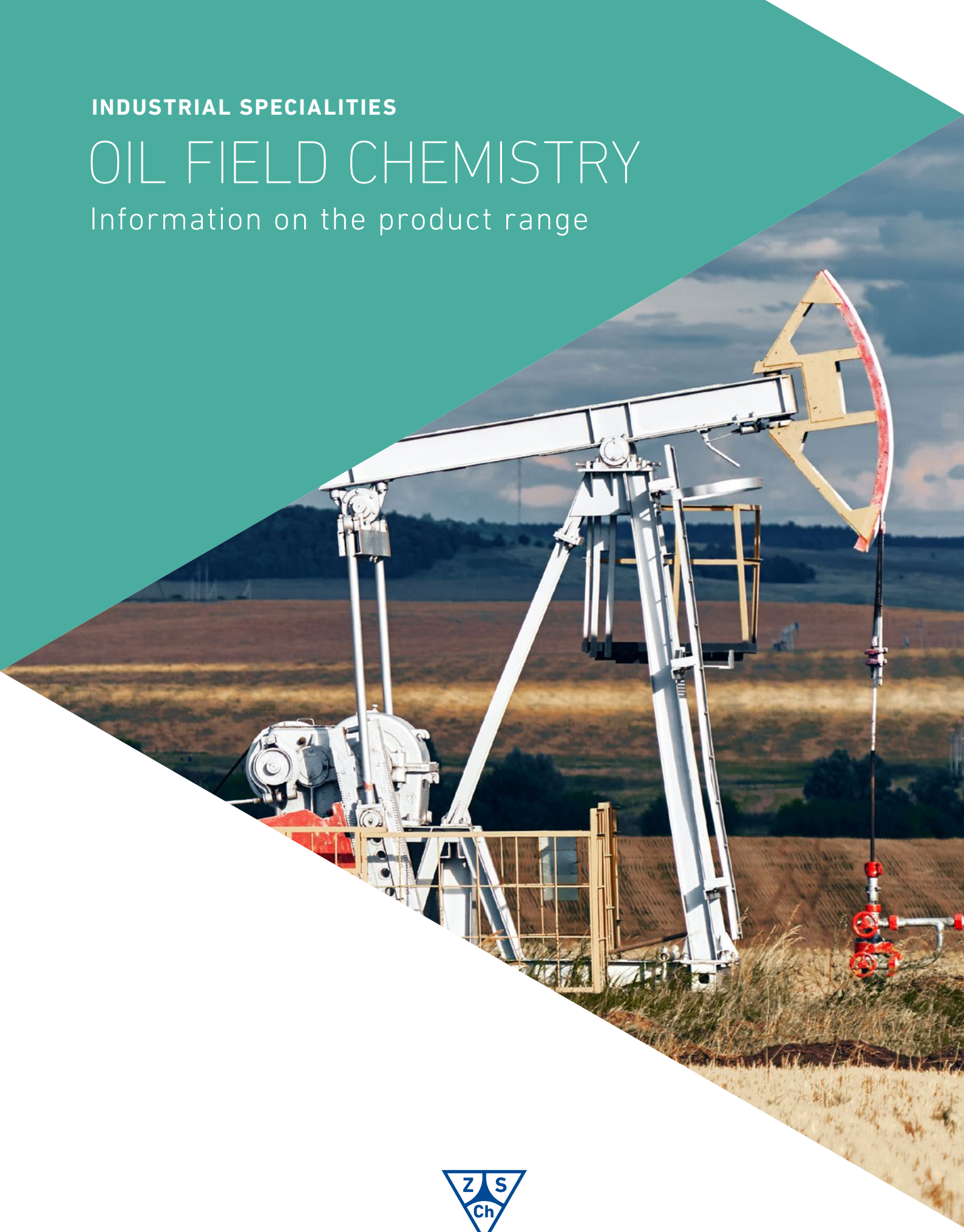
INDUSTRIAL SPECIALITIES

OIL FIELD CHEMISTRY

Information on the product range



ZSCHIMMER & SCHWARZ

OIL FIELD CHEMISTRY

Information on the product range

Crude oil is a natural resource of organic origin. It was formed over many millions of years under the influence of high temperatures and pressures in the absence of air through the decay or transformation of organic material in the upper layers of the earth. In the process, it has formed reservoirs – either as underground lakes or in reservoir rock such as sand or shale formations. Crude oil is and will remain the backbone of the global economy in the near future, both as an indispensable raw material for the chemical and other industries and as a source of energy. Consequently, crude oil still provides about one third of the energy needed worldwide – despite all efforts to increase alternative energy production, such as solar and wind power.

In its energy study published in 2019, the Federal Institute for Geosciences and Natural Resources (BGR) assumes that a global annual production volume of 4.5 billion tonnes (2018) contrasts with technically and economically recoverable oil reserves of 244 billion tonnes. In addition to these, approx. 500 billion tonnes of crude oil have been geologically proven, the exploitation of which does not currently appear technically possible or economically viable. The increasingly economical use of petroleum products and the discovery of new deposits, which can be expected to continue through the use of new technologies, will probably secure the needs of mankind for at least the next two centuries.

In view of the many advantages of crude oil as an energy source with high energy density and as an established chemical raw material, the main focus in the future will be on making crude oil production as effective and efficient as possible. Zschimmer & Schwarz intends to make an important contribution to this with its products.

FAMILIAR CHALLENGES ASSOCIATED WITH CRUDE OIL PRODUCTION INCLUDE:

- Formation of deposits of organic and inorganic nature in production facilities
- Reduction in the permeability of oil-bearing formation
- Separation of water-oil mixtures
- Foaming
- Plant corrosion

The use of chemical additives is intended to achieve a general improvement in process control and an increase in yield. At the same time, protection of the environment and compliance with corresponding environmental standards are of utmost importance.

RANGE OF PRODUCTS

Explore our wide range of efficient and eco-friendly additives which are tailored to your requirements and benefit from our flat hierarchies as well as cross-disciplinary collaboration. Our team will assist you in finding the right products for every challenge.

DEPOSIT RISKS

RISK OF INORGANIC DEPOSITS (SCALE)

A whole range of causes may be involved in the super-saturation of the reservoir water associated with the various extraction and processing steps. For example, pumping back fresh water or – especially in the offshore area – seawater introduces additional ions into the formation, promoting carbonate and sulphate scaling via reciprocal salt pair formation with the original formation water.

In contrast, the pressure loss occurring during extraction results in CO_2 outgassing, which shifts the carbon dioxide/hydrogen carbonate balance towards higher pH values and thus promotes the formation of lime soaps.

The nature of the resulting deposits can be very diverse and different, depending on the process conditions. Deposits can occur both in the sediments themselves, where they can clog pores and channels, and in pipes and pumps of the plant engineering.

Antiscalants of the CUBLEN range from Zschimmer & Schwarz are tailor-made products for the prevention of such precipitations and are characterised by a very high threshold activity. These products are involved in crystal growth processes, thereby preventing the agglomeration of these crystals and creating mobile particles that are prevented from depositing and which can be easily removed. Depending on requirements, they can be used for continuous or intermittent injection or for the formulation of slow-release inhibitors.

RISK OF ORGANIC DEPOSITS (ASPHALTENES, WAXES, CALCIUM NAPHTHENATES)

The above deposits are high-molecular and chemically complex compounds, which occur in varying amounts depending on the crude oil in question. Asphaltenes are mainly found in heavy oils with an API < 20, while naphthenates and paraffins are particularly common in lighter crude oils with a high API. The collective term "asphaltene" does not describe a defined class of substances, but only a petroleum residue which is no longer extractable and in which aromatic ring systems are connected to each other in multiple layers via aliphatic chains. Naphthenates, on the other hand, are cycloalkane-based organic acids.

The precipitation of calcium naphthenates is problematic. Common methods for the prevention of these Ca complexes by simply lowering the pH value lead to unnecessary odour nuisance, for instance when using acetic acid. If, on the other hand, additional complexing agents such as phosphonic acids and phosphate esters are used, the content of free calcium is reduced by masking in addition to lowering the pH value.

These different structures comprising potential organic deposits also entail different additives to control the problem. The products used also differ in respect to whether they are able to either prevent deposits or disperse the substances causing the deposits.

PROCESS CONTROL

STIMULATION (ACID STIMULATION, MATRIX STIMULATION, HYDRAULIC FRACTURING)

These development methods can be used to increase the permeability of oil-bearing rock formations during oil production.

Inorganic acids are used for the chemical stimulation, which either enlarge the pores (sandstone) or even completely dissolve the rock (carbonate-based formations). The corresponding treatment is preferably hydrochloric acid-based, but simple organic acids such as formic or acetic acid can also be used for formations containing carbonates. In sandstone, the use of hydrofluoric acid may also be necessary. Difficulties arise mainly due to the sometimes unpredictable heterogeneous structure of the rock to be treated and the highly aggressive nature of the acids used, which causes corrosion. It is advantageous to add stabilising and inhibiting components to the acidic matrix, which typically suppress the formation of sulphate-based scalings.

In conventional fracking, the rock formation is expanded by pressure, while existing capillaries are stabilised and new capillaries are created. Small quantities of process chemicals are added to the water-based fracking fluids used for this purpose, which help to keep the capillary system open.

CORROSION INHIBITION

As in other major industries, electrochemical corrosion in oil production plants is one of the most serious problems, because it results in high costs at lower economic efficiency. The types and locations of corrosion encountered are extremely diverse, which is why different methods and products are used to inhibit corrosion. In addition to the appropriate choice of material, the use of suitable corrosion inhibitors also plays an important role. However, passivating as well as film-forming products have the greatest importance in terms of volume.

The basic prerequisite for use as a corrosion or scaling inhibitor is a high saline compatibility and, in the case of downhole applications, thermal stability.

Z&S PRODUCTS FOR OIL FIELD APPLICATIONS (EXAMPLES)

PROBLEM REMEDY	SUITABLE STRUCTURE	PRODUCTS
Calcium carbonate scale	Phosphonic acid ATMP, PAPEMP	CUBLEN A 4015, CUBLEN A 3842 CUBLEN PEP 556
Calcium sulphate scale	Phosphonic acids HDTMP, BHMTP	CUBLEN F 3226, F 3016, BTP 480
Strontium or barium sulphate scale	Phosphonic acids DTPMP, BHMTP	CUBLEN D 5113, D 3217 S, D 2945, BTP 480
Magnesium scalings	ATMP-based products	CUBLEN ACS 402, A 3842
Organic deposits	Sorbitan monooleate	LUBRICIT SMO
Stimulation	Phosphonic acid DTPMP	CUBLEN D 5000, CUBLEN DNC 450
Corrosion inhibition	Phosphonic acids HEMPA, DTPMP	CUBLEN R 50, CUBLEN D 3217 S
	Phosphoric acid ester	PHOSFETAL 201, 205, 213
	Phosphoric acid ester	PHOSPHETAL 2-EH, 2280, DA, TDA
Emulsion splitting	Sorbitan esters, ethoxylated	MULSIFAN RT 141
	Fattyalcohol ethoxylate propoxylate	PROPETAL 540
Foam suppression		CONTRASPUM 300, M 4053, W CONC.

EMULSION SPLITTING

Produced crude oils contain different amounts of water, mostly in the form of a water-in-oil emulsion. These emulsions are colloidal dispersions, with tiny droplets of water distributed throughout the oil phase. The salts dissolved in the water droplets are particularly dangerous for the further processing steps of the oil. Normally, emulsion splitting could be achieved by simple heating – however, the crude oil emulsion is also stabilised by certain by-products, which almost always requires the use of chemical additives (demulsifiers). Problems with emulsion splitting are especially to be expected in the case of acid stimulation.

Good demulsifiers rapidly separate the oil from the water, create a sharp water-oil separation line and result in dry oil.

FOAM SUPPRESSION

Foam on the surface or finely dispersed air inside a liquid phase can lead to disturbances in the production process or to quality losses in oil production. Especially during gas separation in the 3-phase separator, the pressure reduction from downhole to normal pressure often leads to extreme foam formation.

A basic distinction must be made between the prevention of foam formation (antifoamers) and foam destruction (defoamers). CONTRASPUM defoamers offer highly effective products based on long-chain fatty alcohols, alkoxylates and esters as well as mineral oils and silicone compounds, depending on the application and task.

Chemistry tailor-made

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