

QUALITY PERFORMS.



Solutions for high performing
Metalworking Fluids

X Additin® **X** Calcinate®

QUALITY WORKS.

LANXESS
Energizing Chemistry

SOLUTIONS FOR CHALLENGING APPLICATIONS

ADDITIVES FOR THE LUBRICANT INDUSTRY. SOLUTIONS FOR HIGH PERFORMANCE

Under the brand names Additin® and Calcinate® the LANXESS Lubricant Additives business unit offers high-performing additives for all kind of metalworking applications. LANXESS additives for metalworking fluids are perfectly suited to meet current challenges and trends like the replacement of chlorinated paraffins, the shrinking availability of group I base oils or the change of manufacturing processes, caused e.g. by the fast growing demand for electric vehicles.

SUSTAINABILITY FOR A GOOD ECOLOGY AND ECONOMY

In recent years, LANXESS has developed new additives used to manufacture environmentally acceptable lubricants that can be certified to the new European Ecolabel (EEL). Some additives are even based on renewable raw materials.

QUALITY WITHOUT COMPROMISE

One of LANXESS primary goals is the ongoing improvement of our high quality level. Activities in this context are geared to our ISO 9001 and ISO 14001 certifications, which serve as an incentive to continuously improve our production processes.

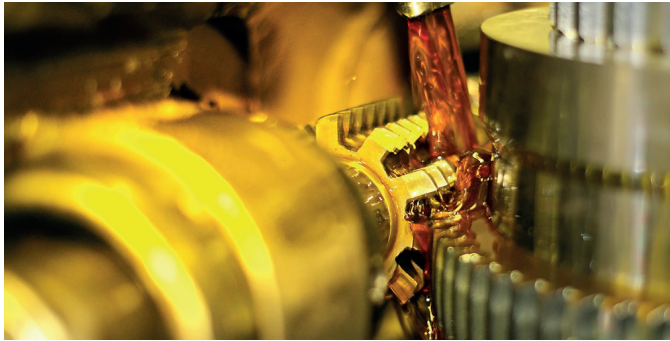
FOCUSING ON CHALLENGES

Thanks to a worldwide distribution system, additives as well as excellent technical expertise are available practically everywhere around the world. We are a leading solution provider for industrial lubricant applications worldwide.

	Product description	Chemical description	Characteristics	Applications
Additin® EP	Extreme-pressure additives (light and dark, active and inactive sulfur carriers)	Sulfurized compounds like fatty oils, fatty acids or -ester, and/or olefins	Improves extreme-pressure characteristics (load-carrying capacity) and protection against wear	Metalworking fluids, transmission and slide-way oils, greases
Additin® SP	Specialties	Ester, N-containing heterocycles: Triazole and thiazazole derivatives	Improves lubricity, antiwear effect and load-carrying properties and acts as deactivator for non-ferrous metals	Hydraulic, transmission, turbine, compressor, engine and special oils, greases, metalworking fluids
Additin® PA	Additive packages	Combination of extreme-pressure, antiwear and anti-corrosion additives as well as antioxidants	Consists of a variety of carefully matched components to correspond to specific application standards	Ashless and ash-containing hydraulic oils, emulsifying and detergent hydraulic oils, industrial gear oils, slideway oils, greases and metalworking fluids
Calcinate®	Synergistic extreme pressure additives and corrosion inhibitors for ferrous metals	Neutral and over-based calcium sulfonates	Acts as a synergistic extreme-pressure booster in combination with selected Additin® EP products and improves the anti-corrosion properties	Metalworking fluids, transmission and slide-way oils, greases

EXTREME-PRESSURE ADDITIVES

MORE THAN JUST OIL-SOLUBLE SULFUR



Sulfur carrier EP additives

LANXESS' Additin® sulfur-carrier additives are mainly used in metalworking lubricants, they reduce wear on metal surfaces and prevent cold welding even under extreme conditions, such as high surface pressures and high material removal rates. They can be applied in conjunction with other additives in formulations of industrial gear oils, greases and hydraulic oils to increase the loadbearing capacity of the lubricating oil or grease.

Because of their beneficial eco-toxicological profile, light-color sulfur carriers are increasingly replacing other chemical substances such as chlorinated paraffins.

Scopeblue Additin® extreme pressure additives

The LANXESS Scopeblue® brand label identifies products that either contain at least 50% sustainable raw materials or have a carbon footprint that is at least 50% lower than that of conventional products. Scopeblue-labeled light-color sulfur carriers stand out on account of their sustainability footprint, favorable eco-toxicological profile and superior performance in modern metalworking processes.

- Based on renewable raw materials such as plant oils
- Meet requirements of the LuSC ("Lubricant Substance Classification") list - prime reference for formulators of lubricants for EU Ecolabel

The following Additin® additives already meet the Scopeblue requirements: RC 2315, RC 2317, RC 2410, RC2415, RC 2418, RC 2515

Applications

Products in the Additin® Extreme-Pressure (EP) range are generally used as a backbone in the formulation of modern neat oil and water-based metalworking fluids as well as greases, transmission and slideway oils. LANXESS provides the right solution for any application and offers competent assistance for selecting the most suitable alternatives.

Mode of action:

Reduced cutting force and lower friction

Additin® EP products chemically react with the metal surface to form a protective sulfur-containing film. This reduces direct metal-to-metal contact, thereby reducing friction as well as adhesive wear, caused by cold welding.

This product group was specially developed to meet the latest requirements of the lubricant oil industry and offers precisely the characteristics required in high-performance environments:

- Low-odor, light-colored additives with good solubility in most base fluids
- Multifunctional performance due to efficient friction reduction and galling protection
- Less harmful to environment and humans compared to existing chlorine based technology

Additin® EP / light-color, low-odor sulfur carriers

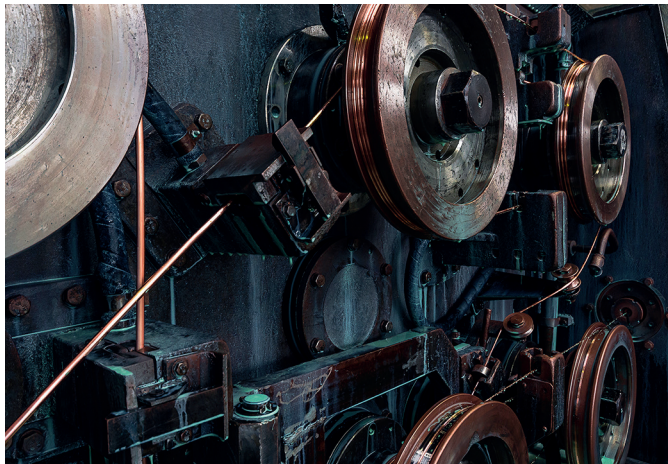
Additin®	Chemical basis	Total sulfur	Active sulfur	Viscosity 40 °C	Color	Cu-Corr. 3h/100 °C	Main applications				
							Metalworking fluids	Industrial gear oils	Greases	Slideway oils	
		approx. %	ASTM-D 1662 approx. %	ASTM-D 445 approx. mm ² /s	ASTM-D 1500 typical	ASTM-D 130 typical	Oils	Water-miscible			
							Cutting	Forming			
Based on esters											
RC 2310	Fatty acid ester	11	1	30	3,5	1b	■				■
RC 2315	Fatty acid ester	15	4	45	3,5	1b	■				■
RC 2317	Fatty acid ester	17	8	55	4,5	3a-3b	■	■			■
Based on triglycerides											
RC 2410	Triglyceride	10	1	350	3,5	1b	■	■			■
RC 2411	Triglyceride	9,5	< 1	230	3	1b	■	■			■
RC 2415	Triglyceride	15	5	300	4	3a-3b	■	■	■		■
RC 2416	Triglyceride	15	5	230	5,5	1b-3a	■	■	■		■
RC 2418	Triglyceride	18	9	220	4,5	3b-4c	■	■	■		
Based on olefins											
RC 2515	Fatty acid ester / Olefin	15	4	640	4	1b	■	■		■	■
RC 2516	Fatty acid ester / Olefin	15	4	650	4	1b	■	■		■	■
RC 2526	Fatty acid ester / Olefin	26	15	750	4,5	3a-4b	■	■	■		■
RC 2540	Dialkylpentasulfide	40	36	45	2,5	3b-4b	■	■	■		■
RC 2541	Dialkylpentasulfide	40	35	45	2,5	1b	■	■			■
RC 2542	Dialkylpentasulfide	40	35	45	3	1b	■	■			■
RC 2547	Sulfurized isobutene	47	20	3,4	1,5	1b-2a				■	■

Additin® EP / dark-color sulfur carriers

Additin®	Chemical basis	Total sulfur	Active sulfur	Viscosity 40 °C	Color	Cu-Corr. 3h/100 °C	Main applications				
							Metalworking fluids	Industrial gear oils	Greases	Slideway oils	
		approx. %	ASTM-D 1662 approx. %	ASTM-D 445 approx. mm ² /s	ASTM-D 1500 typical	ASTM-D 130 typical	Oils	Water-miscible			
							Cutting	Forming			
RC 2811 (M 28.001)	Triglyceride	11	1	1400	D8	1b	■	■			■

SPECIALTIES

SOLUTIONS FOR PARTICULAR REQUIREMENTS



Synthetic esters and polymers

These additives are based on selected raw materials to optimize affinity to different metal surfaces, such as stainless steel (e.g. Additin® RC 8100) or aluminum (e.g. Additin® RC 8103).

EP additives and non-ferrous metal deactivators

Non-ferrous metal deactivators with special EP properties (e.g. Additin® RC 8210) play an important role in reducing corrosion and aging. These additives act as synergists to primary and secondary antioxidants.

Additin® SP / synthetic esters and polymers

Additin®	Chemical basis	Density 20 °C approx. kg/m ³	Viscosity 40 °C approx. mm ² /s	Mineral oil content approx. %	Main applications				
					Metalworking oils/fluids	Power trans- mission oils	Industrial gear oils	Greases	Other
RC 8000	Sulfur-linked polymer	990	highly viscous	0	■			■	
RC 8012	Sulfur-containing semi-synthetic ester	950	60	0	■	■	■	■	Offshore lubricants
RC 8100	Polycarboxylate	1000	3000	0	■			■	Slideway oils
RC 8103	Trimethylpropane ester of special fatty acids	940	85	0	■			■	Slideway oils

Additin® SP / extreme-pressure additives and non-ferrous metal deactivators

Additin®	Chemical basis	Density 20 °C approx. kg/m ³	Bulk density approx. kg/m ³	Sulfur content approx. %	Mineral oil content approx. %	Main applications				
						Metalworking oils/fluids	Power trans- mission oils	Industrial gear oils	Automotive gear oils	Greases
RC 8210	Dimercapto thia- diazole derivative	1070	-	30	0	■	■	■	■	■
RC 8213	Dimercapto thia- diazole derivative	1080	-	36	0	■	■	■	■	■
RC 8239	Tolyltriazole derivative	950	-	0	0	■	■	■	■	■ Fuels

ADDITIN® PA

OUR KNOW-HOW AND SERVICE IN ONE PACKAGE

Metalworking Additive Packages

LANXESS Metalworking Additive Packages are perfect options to reduce the complexity of metalworking fluid formulations, as well as the number of raw materials that have to be stored. They can be used as convenient solutions to fulfil the demands of challenging applications without expensive and lengthy development work. All packages are free of zinc and chlorine.

Additin® RC 9701 is a specialized additive package, primarily developed for the formulation of high-speed grinding oils for grinding cemented carbide and high speed steel. With Additin® RC 9701, the material removal rate can be significantly increased and the clogging of the grinding wheel is reduced. It prevents cobalt leaching and thus avoids cobalt accumulation in the grinding oil and increases the surface quality of the manufactured parts. Additin® RC 9701 is soluble in group I – IV base oils.

Additin® RC 9720 is an all-round metalworking additive package. Depending on its treat rate and on the viscosity of the base oil, it can be used to manufacture metalworking oils for almost every metal removal and metal forming process. It is also suitable for machining many different metals and alloys including yellow metals, aluminum, cast iron, high alloyed steel, stainless steel and titanium. Additionally, it can be used as an EP booster for soluble oils and semisynthetic emulsifiable metalworking fluids.



Additin® M 97.003N

Additin® M 97.003N is a slideway oil additive package with excellent lubricity and demulsification properties. It effectively prevents stick-slip even at high loads and very low feed rates. Additionally, Additin® M 97.003N provides excellent corrosion protection for the machine tool slideways and high oxidative stability.

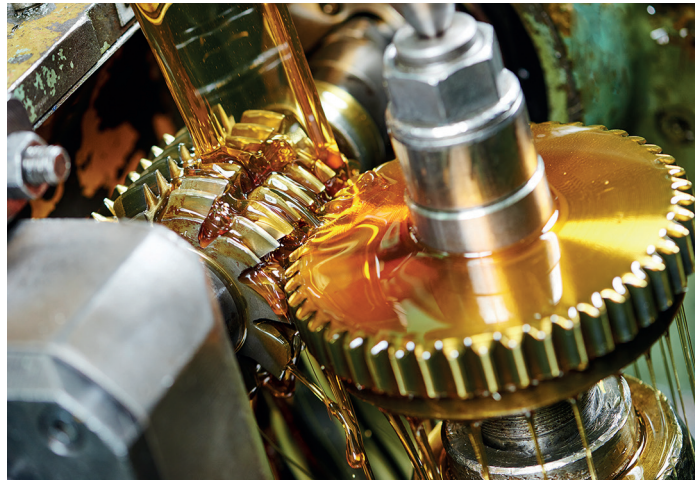
Additin® PA / metalworking packages

Additin®	P	S	Viscosity 40°C ASTM D445 approx. mm²/s	Materials						Main applications			
				Steel	Stainless steel	Aluminum	Yellow metals	Titanium	Cemented carbides	Cutting	Grinding	Forming	Stamping
RC 9701	3.0	6.6	36	■			■		■		■		
RC 9720	0.3	16	105	■	■	■	■	■		■		■	■

CALCINATE® OVERBASED CALCIUM SULFONATE CORROSION INHIBITORS AND EXTREME PRESSURE ADDITIVES

Rust inhibitors and EP-synergists

Our complete line of Calcinate® overbased calcium sulfonates are used for both corrosion inhibition on ferrous metals and EP performance in industrial and metalworking lubricant applications. These products can be used on a variety of metals. They may find use in metal working fluids, industrial oils and grease. Overbased detergents can also be effectively used to prevent wear and provide EP performance to lubricants, particularly in synergistic combinations with sulfurized olefins like Additin® RC 2540. Typically products containing amorphous calcium carbonate are used for applications where oil clarity is critical, while products containing the crystalline form of calcium carbonate are used when additional EP performance is required.



Property	Method	Calcinate®					
		NC	C300CS	OTS	OR	C-400CLR	C-400W
Carbonate form			Crystalline	Amor- phous	Amorphous	Amorphous	Crystalline
Average micelle size, nm		0.5–10	40–80	10–30	10–30	10–30	100–200
Calcium, wt%	ASTM D4951	2.7	10.5	12.0	15.2	15.2	14.5
Ca sulfonate, wt%	ASTM D3712	44.5	18.5	28.3	18.5	18.5	17.6
TBN, mg KOH/g	ASTM D2896	30	285	305	405	405	385
Viscosity @ 100 °C, cSt	ASTM D445	55	100	75	75	75	–
Viscosity @ 25 °C, cPs	–	–	–	–	–	–	40,000
Sp. gravity @ 15 °C	ASTM D4052	0.96	1.10	1.13	1.20	1.20	1.15
Color (dilute)	ASTM D1500	5	5	5	5	5	5
Free alkalinity, mg KOH/g		–	20	30	10	1	–
Copper strip corrosion	ASTM D130	1b	1b	1b	1b	1b	1b
Rust	ASTM D665A	Pass	Pass	Pass	Pass	Pass	Pass
4-Ball Wear*	ASTM D4172	0.63	0.35	0.31	0.31	0.32	0.36
4-Ball EP*, weld	ASTM D2783	160	200	200	200	250	250
Pin and Vee-Block*, lb.	ASTM D3233A	977	2353	1963	1618	1686	4500

* 10% in 100 SUS naphthenic oil

ADDITIVES FOR METALWORKING FLUIDS IN ELECTRIC VEHICLE PRODUCTION

Additive	Deep drawing	Stamping/ fine blanking	Cold impact extrusion	Cu- and Al- wire drawing	Fin stamping	Grinding	Honing	Broaching
Polar, friction reducing additives								
Additin® RC 2416	■		■					
Additin® RC 2515	■		■					■
Additin® RC 2516	■	■	■	■		■		
Additin® RC 5001				■		■		
Additin® RC 5010		■		■	■	■	■	
Additin® RC 8103		■	■	■	■			■
Additin® RC 8100								
Highly reactive EP additives								
Additin® RC 2317						■	■	
Additin® RC 2418						■		■
Additin® RC 2526	■	■	■					■
Additin® RC 2540	■	■				■	■	■
Additin® RC 5201/5202						■		
Additin® RC 5250						■		
Yellow metal inhibitor								
Additin® RC 5800				■				
Additin® RC 8239	■	■	■	■	■	■	■	■
EP-additive and yellow metal inhibitor								
Additin® RC 8213							■	
Overbased Ca-Sulfinates								
Calcinat® OR	■	■				■		■
Calcinat® C-300 CS	■	■	■					
Calcinat® C-400W			■					
Anti-wear additives								
Additin® RC 3038	■	■						
Additin® RC 3080			■					■
Additin® RC 3740		■					■	
Additin® RC 3760						■	■	
Additin® RC 3890	■	■	■			■		■
Additive packages								
Additin® RC 9410						■		
Additin® RC 9720	■	■	■					■
Antioxidant								
Additin® RC 7120	■	■	■		■	■		■

Data provided in the table above is characteristic of the product grade, and does not constitute a specification. Further information is given in technical and material safety data sheets for individual Additin® and Calcinat® products. Samples, supplementary data, formulating advice and papers/presentations giving further details of our additive chemistry can be supplied on request.

SULFUR CARRIERS

PROPERTIES AND ADVANTAGES IN METALWORKING APPLICATIONS

Sulfur Carriers

Sulfur carriers are sulfur containing organic compounds, made from olefins, natural oils or synthetic esters. They contain 1 to 5 sulfur atoms, forming a kind of bridge between the olefin and ester parts.

Sulfur carriers work perfectly as EP-additives in metalworking applications by forming protective layers of metal sulfide which prevent galling and cold welding under high mechanical or thermal stress. Polar centers from the ester or triglyceride part increase their ability to adsorb on metal surfaces and to form friction reducing layers already at low machining temperatures.

Sulfur carriers are not labelled as hazardous components. Some of them are partially made from renewable raw materials and/or suitable formulation components in EU Ecolabel and US VGP compliant formulations.

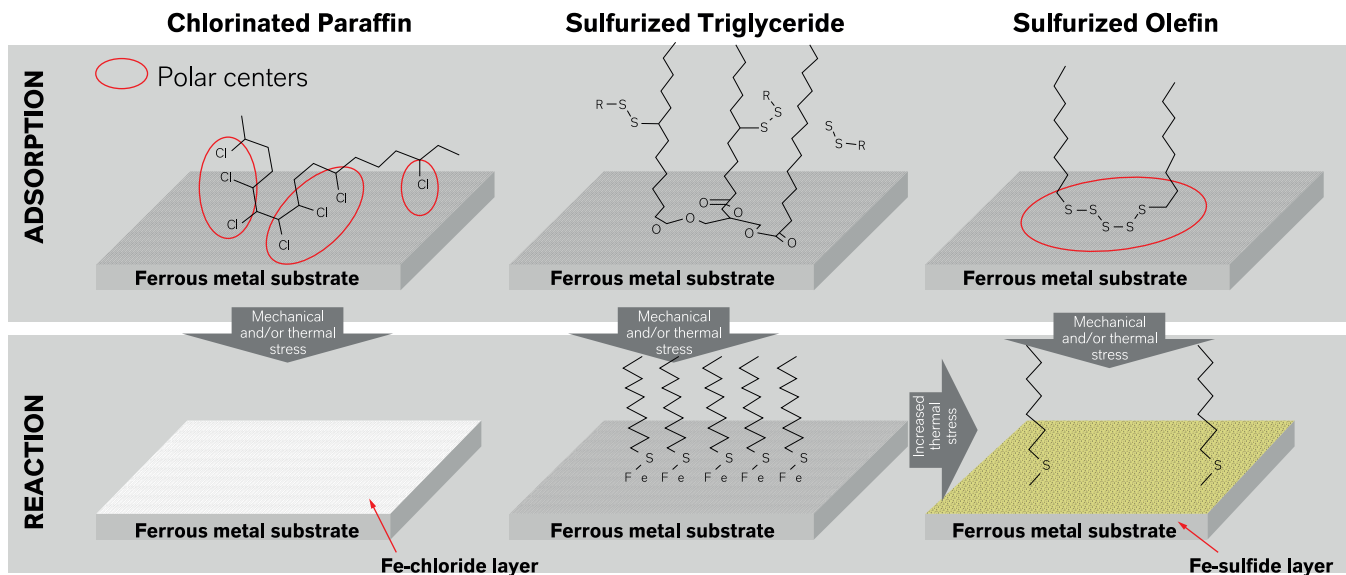
LANXESS developed its first light colored sulfurized ester Additin® RC 2317 in 1957. Most sulfur carriers at that time were dark in color, with a strong odor and limited stability.

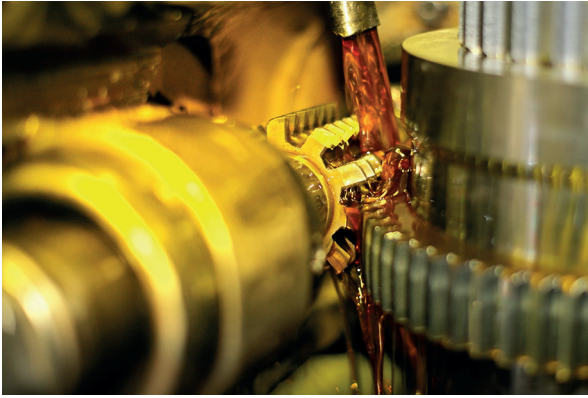
Chlorinated paraffins

Chlorinated paraffins are another group of EP-additives which are still used in some metalworking processes. They can effectively prevent cold welding at low machining speeds. At higher machining speeds that also entail higher temperatures on tools and workpieces, they tend to decompose and form hydrogen chloride which causes severe tool wear. In presence of water or moisture, chlorinated paraffins hydrolyze and form hydrochloric acid which corrodes tools, workpieces and the entire machine tool.

Short chain chlorinated paraffins are already banned in many countries because they are persistent and bioaccumulative and suspected of causing cancer. There are also intentions to ban or restrict the use of medium chain chlorinated paraffins by the European Union and the United Nations Environment Program.

Formation of Adsorption and Reaction Layers by EP-Additives



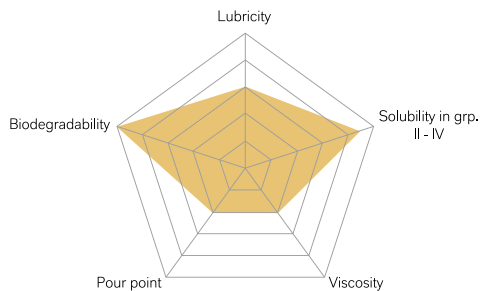


Sulfur Carrier Properties

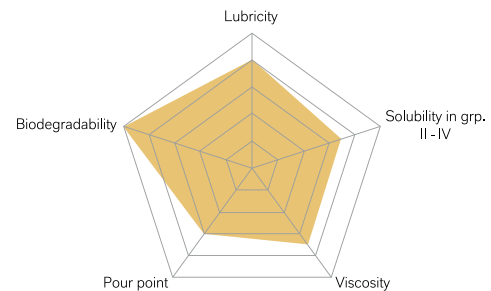
Compared to chlorinated paraffins, Additin® RC 2xxx sulfur carriers are extremely versatile and are ideal for reducing friction and preventing adhesive and abrasive wear in boundary lubrication. They provide outstanding efficiency over a broad temperature range from slow to high speed machining processes. Even more, their performance can be further increased by using synergistic combinations with overbased sulfonates, polycarboxylates and other polar compounds. The choice of sulfur carriers can be adapted to the specific requirements of different metalworking processes by varying properties like total sulfur content, active to inactive sulfur ratio, lubricity, polarity, solubility in different base oils, corrosion to copper and yellow metals and others.

Raw material related properties of Additin® RC sulfur carriers.

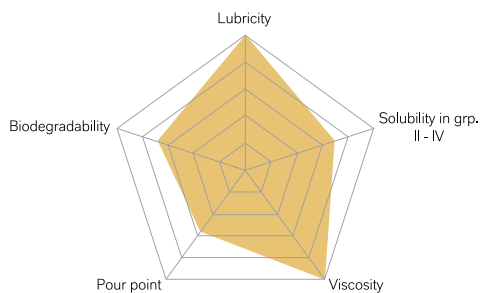
Sulfurized Ester



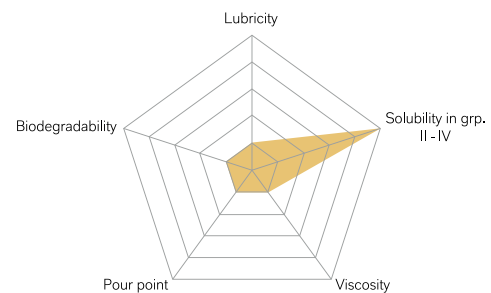
Sulfurized Triglyceride



Sulfurized Triglyceride/Olefin



Sulfurized Olefin

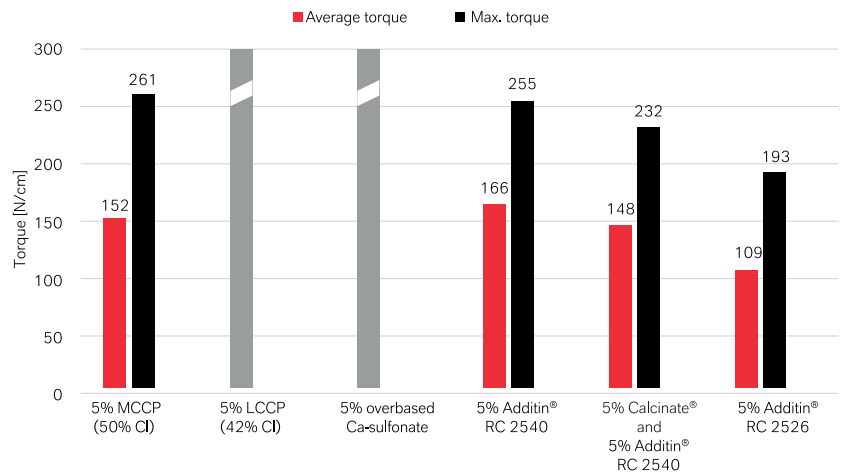


Sulfur carriers outperform chlorinated paraffins in many aspects:

- Excellent performance even at high machining speeds which can be further improved by synergistic combinations with other additives
- Different molecular structures make them easily adaptable to multiple applications
- No increase of tool wear at high machining speeds and temperatures
- More sustainable and eco-friendly. Scopeblue Additin® products have low or no impact on the environment and show no health hazards.
- LANXESS has considerable technical expertise and offers consulting to help guide you in developing CLP replacement formulations with superior performance characteristics

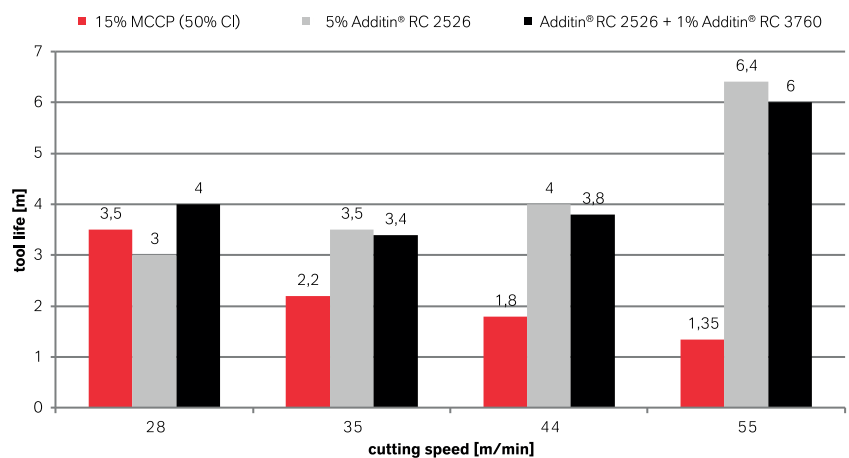
Thread cutting in stainless steel, test results

Some laboratory tests and field tests demonstrate the advantage of using sulfur carriers in metal-working fluids: When thread cutting stainless steel, the performance advantages of sulfur carriers as single additives or in synergistic combination with an overbased calcium sulfonate, are clearly visible. With 5% medium chain chlorinated paraffin (MCCP), diluted in group I ISO VG 46 mineral oil, the recorded average torque was 152 N/cm and the maximum torque was 261 N/cm. Tests with 5% long chain chlorinated paraffin or 5% overbased calcium sulfonate failed because the tapping tool broke in each attempt. When running the tapping torque test with a cutting oil containing 5% of active sulfurized olefin Additin® RC 2540, the average torque was slightly higher and the maximum torque was slightly lower than with the MCCP. The synergistic combination of the overbased calcium sulfonate Calcinat® OR and Additin® RC 2540 led to a further reduction of average and maximum torque whilst the lowest torques were achieved with 5% Additin® RC 2526 which is a special sulfurized mixture of triglycerides and olefins, offering high polarity and high sulfur activity.



Milling oil test results, cutting speed vs. tool life

A field test on a milling machine again highlights the deficiencies of chlorinated paraffins. A milling oil containing 15% MCCP showed significantly reduced tool life with increasing machining speed: The tool life declined from 3.5 meters cutting path at a cutting speed of 28 meter per minute to only 1.18 meters at 55 meters per minute cutting speed. The chlorinated paraffin containing cutting oil was significantly outperformed by only 5% of the special sulfurized EP additive Additin® RC 2526. At 28 m/min cutting speed, 1% antiwear additive Additin® RC 3760 were added to exceed the performance of the MCCP containing cutting oil. At higher cutting speeds, Additin® RC 2526 becomes very efficient and clearly outperforms the chlorinated paraffin, even without the addition of other additives.





LANXESS Corporation

Business Unit Lubricant Additives

2 Armstrong Road

Shelton, CT 06484

USA

Tel: +1-203-573-2000

lubricant.additives@lanxess.com

lab.lanxess.com

The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control. Therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.

Health and Safety Information: Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the LANXESS products mentioned in this publication. For materials mentioned which are not LANXESS products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be followed. Before working with any of these products, you must read and become familiar with the available information on their hazards, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets and product labels. Consult your LANXESS Corporation representative or contact the Product Safety and Regulatory Affairs Department at LANXESS.

Regulatory Compliance Information: Some of the end uses of the products described in this publication must comply with applicable regulations, such as the FDA, NSF, USDA, CPSC and BfR. If you have any questions on the regulatory status of these products, contact your LANXESS Corporation representative or Regulatory Affairs Manager at LANXESS.

Note: The information contained in this publication is current as of April, 2024. Please contact LANXESS Corporation to determine if this publication has been revised.

©2024 LANXESS, Additin®, Calcinat®, LANXESS and the LANXESS Logo are trademarks of LANXESS Deutschland GmbH or its affiliates. All trademarks are registered in many countries in the world.