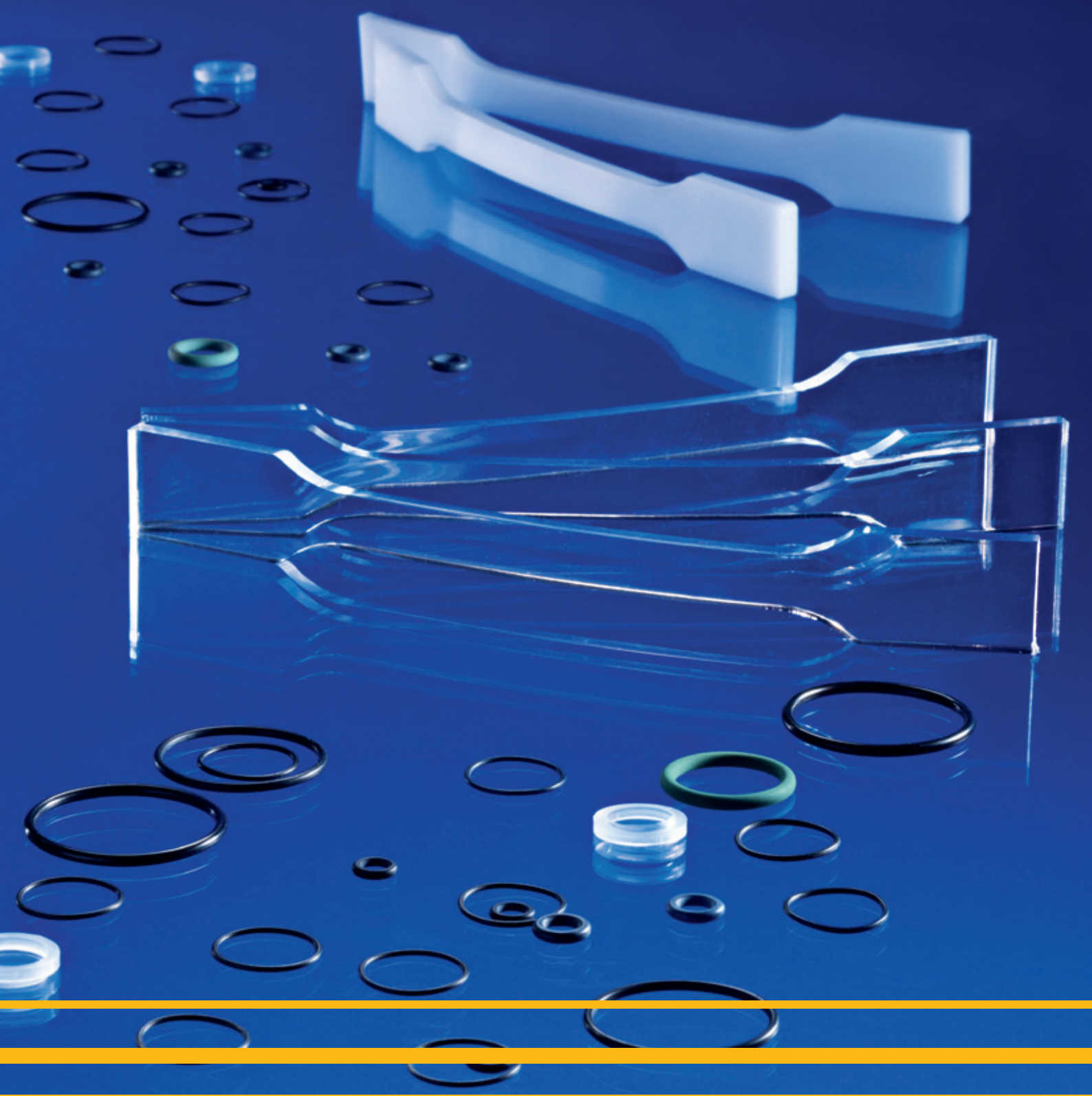


Lubricants compatible with elastomers and plastics

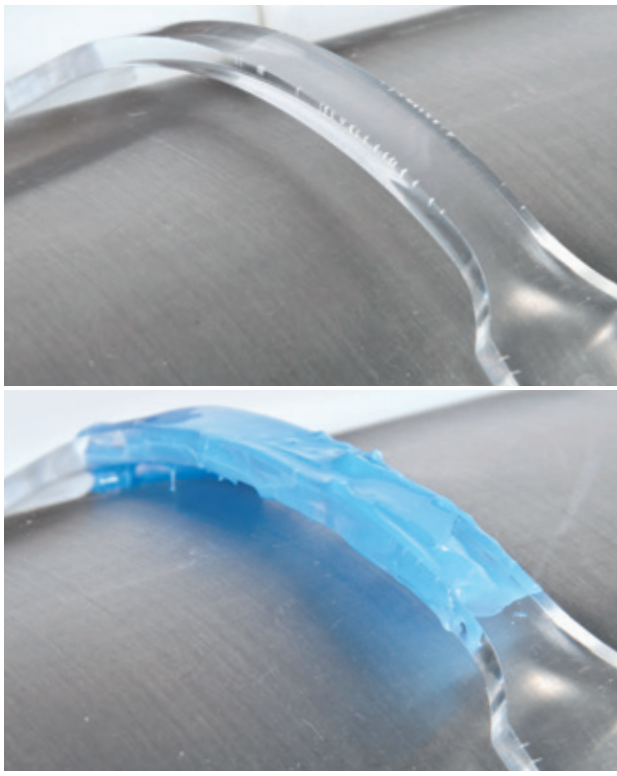
BECHEM
LUBRICATION
TECHNOLOGY

Tension stress cracking caused by lubricants in contact with thermoplastics or thermosets

The application of lubricants in contact with plastic materials is of growing importance. An essential requirement is the compatibility between lubricant and polymeric material. In the BECHEM laboratories a large variety of test equipment is available to check the compatibility of these materials.
BECHEM products for plastic lubrication excel in outstanding compatibility with plastic and have proven their suitability worldwide in many applications under severest conditions.

In case of internal and / or external tensions at formed parts of thermoplastic and thermosetting polymers tension cracks may occur when getting in contact with lubricants.

Caused by wetting, diffusion and lubricant properties the following physical process can take place in case of incompatibility with the lubricant:
Potential microscopically small cavities or tension cracks will lead to breakages due to the wetting and swelling ability of the lubricant. The physical condition of the highly polymeric formed construction part (morphology, molecular mass, molecular mass distribution, branching, cross-linking, internal stress and orientation) determines this process. Polycarbonate, polystyrene, polymethylmethacrylate, styrene-acrylonitrile-copolymer and polyvinyl chloride without plasticizers are especially susceptible to tension cracking. Tension stress cracking behaviour can be determined by using standardised test specimen or the corresponding construction part itself.
Tension crack formation can be partly or fully prevented by selecting the suitable lubricant.



Test specimen in bent strip test acc. to
EN ISO 22088-3 without and with lubricant

Elastomer and plastic compatibility of different lubricants

Lubricating greases and their behaviour towards sealing materials (elastomers)

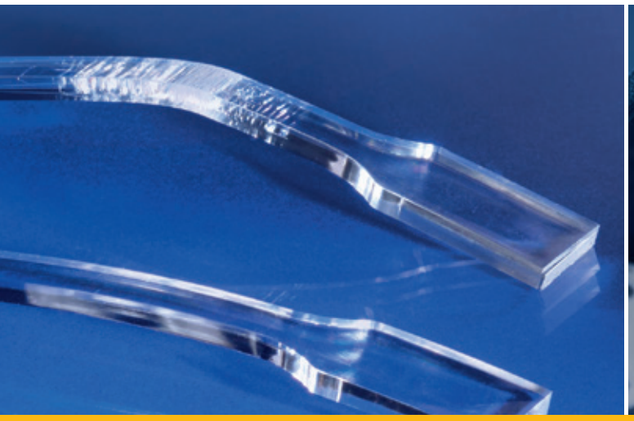
Abbreviation	Elastomers	Lubricating grease group A	Lubricating grease group B	Lubricating grease group C	Lubricating grease group D	Lubricating grease group E	Lubricating grease group F
		Mineral oils with metal soaps, polyurea or inorganic thickeners e.g.:	Diester oils, polyglycols, polybutenes with metal soaps or inorganic thickeners e.g.:	Special ester oils with polyurea or inorganic thickeners e.g.:	Synthetic hydrocarbons with metal soaps, polyurea or inorganic thickeners e.g.:	Silicone oils with PTFE (polytetra-fluoroethylene), metal soaps or inorganic thickeners e.g.:	PFPE (perfluoropolyether oils) with PTFE (polytetrafluoroethylene) e.g.:
		Berulub FA 46 Berutox M 21 HT BECHEM High-Lub LT 2 EP BECHEM High-Lub SW 2	**Berulub FK 30 Berulub FK 35 B Berulub Hydrohaf 2 Berulub KR-EL 2 Berulub KR-EP 2 Beruplex LG 21 F**	**Berulub FK 64 Berulub FK 97 E Berulub FK 122 Berulub PAL 1**	**Berulub FB 34 Berulub FH 57 Berulub FR 16 Berulub FR 43 Berulub FR 70 Berusoft 10 Berusoft 15 Berutox FH 28 KN BECHEM Ceritol PK 1 BECHEM Ceritol PK 1 Soft**	**Berulub FO 34 Berulub OX 40 EP Berulub Sihaf 2 Berusil FO 22 Berusil FO 22 F Berusil FO 25 Berusil FO 26 Berusil FO 36-2**	**Beruglide L Berutemp 500 T 2 Berutox VPT 54-2 Berutox VPT 64-2 Berutox VPT 64 BN 3 Berulub FK 33 Berulub FK 164-2**
ACM	acrylate rubber	●	○	●	●	●	●
CR	chloroprene rubber	◒	○	◒	◒	◒	●
EPDM	ethylene-propylene-diene rubber	○	◒	○	◒	●	●
FKM/FPM	fluorinated rubber	●	◒	●	●	●	●
FEPM	propylene-tetrafluoroethylene rubber	●	●	●	●	●	●
HNBR	hydrogenated nitrile-butadiene rubber	●	○	●	●	●	●
NBR	nitrile-butadiene rubber	●	○	●	◒	◒	●
SBR	styrene-butadiene rubber	◒	○	◒	◒	◒	●

Lubricating greases and their behaviour towards plastic materials (thermoplastics/thermosets)

Abbreviation	Plastics (thermoplastics/thermosets)	Lubricating grease group A	Lubricating grease group B	Lubricating grease group C	Lubricating grease group D	Lubricating grease group E	Lubricating grease group F
ABS	acrylonitrile-butadiene-styrene	●	◒	◒	●	◒	●
PA 6	polyamide (polycaprolactam)	●	●	●	●	●	●
PC	polycarbonate	◒	○	◒	◒	◒	●
PC/ABS	polycarbonate/acrylonitrile-butadiene-styrene	◒	○	◒	◒	◒	●
PE	polyethylene	●	●	●	●	●	●
PET/PBT	polyethylene-/polybutylene terephthalate	●	●	●	●	●	●
POM	polyoxymethylene, polyacetal	●	●	●	●	●	●
PP	polypropylene	●	●	●	●	●	●
PTFE	polytetrafluoroethylene	●	●	●	●	●	●
PU	polyurethane	●	●	●	●	●	●
PVC	polyvinyl chloride	●	●	●	●	●	●
TPE-E	thermoplastic elastomer (polyether/polyester)	◒	◒	◒	◒	◒	●

The mentioned compatibilities are based on laboratory tests and references. In view of the variety of used raw materials as well as the complex chemical and morphological structure of the polymers the given information represent general tendencies only. In individual cases and especially prior to serial production the compatibilities should be confirmed by the supplier or verified in laboratory tests.

● resistant ◒ partly resistant ○ not resistant



Swelling or shrinking of elastomer sealing materials (elastomers) in contact with lubricants

In many technical applications elastomers are used as sealing material. In contact with lubricants interaction with the elastomer occurs. There are two ways of interaction:

Physical Interaction

Physical interaction comprises two simultaneous processes:

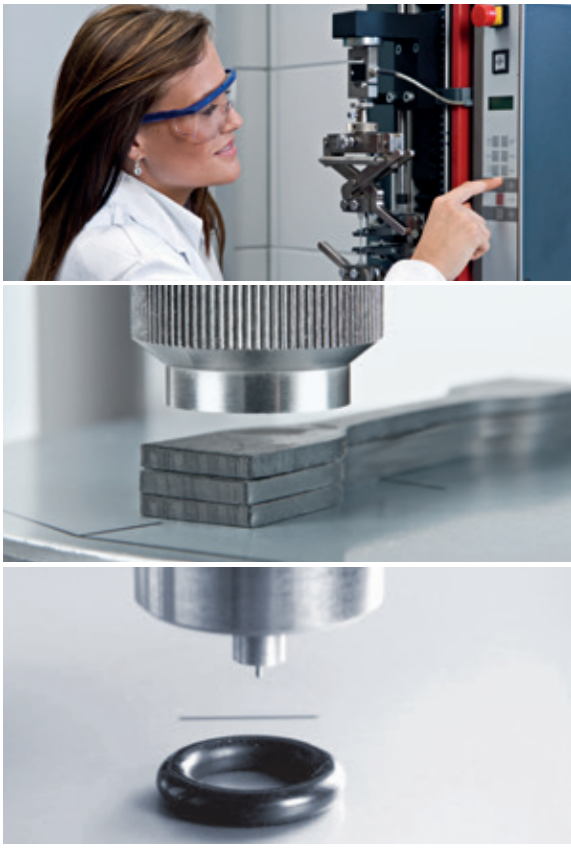
A: Absorption of the lubricating medium by the sealing material

B: Extraction of the soluble parts – especially plasticizers – from the sealing material

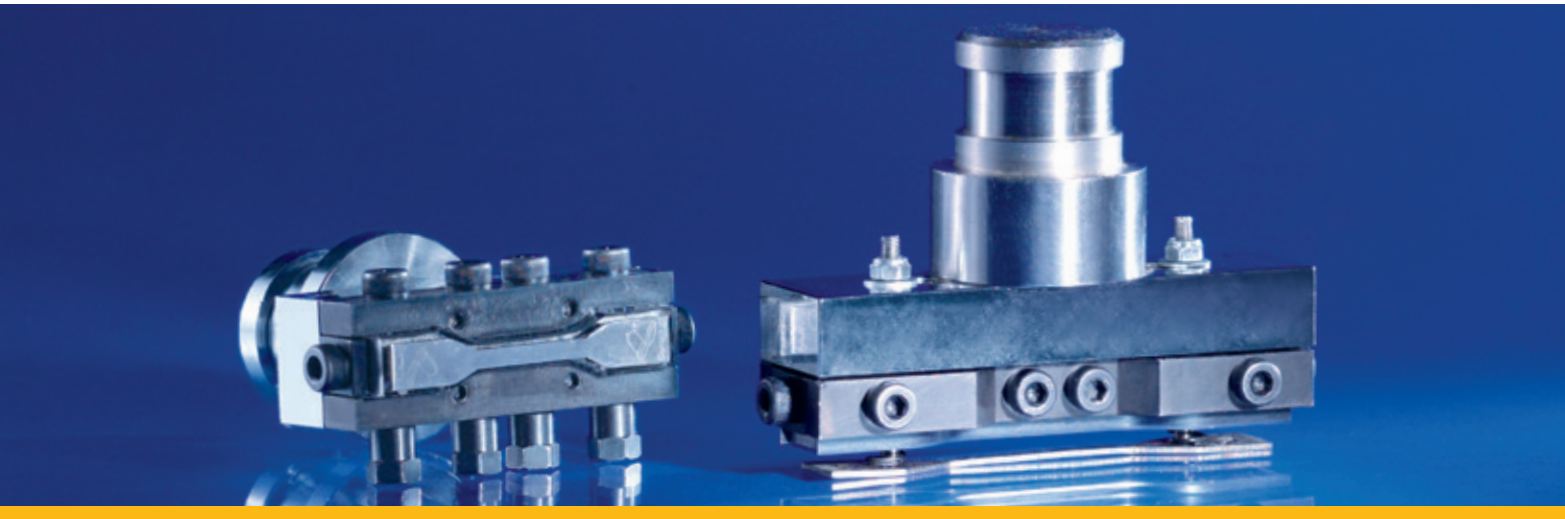
The result is always a change in volume, i.e. swelling when A exceeds B or shrinking when B exceeds A. Each change in volume – whether swelling or shrinking – causes changes in the mechanical properties of the sealing material. This relates to hardness, elasticity, tensile strength and break elongation. Depending on the extent, these changes may lead to a complete destruction of the sealing material.

Chemical Interaction

In case of chemical interaction the parts of the lubricating medium react with the sealing material which will change its structure, e.g. cross-linking or degradation. Slight chemical changes of the sealing material can lead to serious changes in the physical properties (embrittlement). The compatibility of elastomers with lubricants is examined according to defined test methods. In most cases changes in volume and hardness as well as tensile strength after a certain time of exposure under well defined conditions are analysed to determine compatibility.



Tensile strength test (upper picture) and hardness tests of elastomers



Lubrication Solutions for Industry

With 180 years of experience, BECHEM is one of the leading manufacturers of premium quality special lubricants and metal working fluids.

Close cooperation with research institutes, industry partners and product users as well as the knowledge, skills and major commitment by our staff are guarantees of new and innovative high performance lubricants, which contribute to the success of our customers at home and abroad.

A powerful network of distributors and several national and international production sites ensure our products are readily available worldwide.

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CARL BECHEM GMBH · Weststr. 120 · 58089 Hagen · Germany
Phone +49 2331 935-0 · Fax +49 2331 935-1199 · bechem@bechem.de · www.bechem.com

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