



Competence in Lubricants

Lubricant Expo

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Current substances in the public spotlight Alternatives available?

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Company profile

- Globally active
- 50 years of experience
 - development, production and sales of special lubricants
- Greases, pastes, oils, special metal-working fluids, maintenance products
- Automotive, food, electronics, plastic
- ISO 9001, ISO 14001 and product related certifications
ISO 21469, H1, ...



Outline

- Fluorine chemistry under investigation
- Nanoparticles in lubricants
- Discussion

Fluorine chemistry

- PFOA – PerFluoroOctanoicAcid
 - PFOA is a compound used in the manufacture and processing of some Fluoroelastomers and Fluoropolymers
- PFOA found in traces in drinking water

Fluorine chemistry under investigation

- PFAS – PerFluoroAlkylatedSubstances
 - PFAS is an acronym for per- and polyfluorinated chemicals
 - This group of substances includes more than 4,700 different substances
 - EU wants to restrict the use of all of them due to potential health risks
 - DEFLUORINATION - low-temperature mineralization of perfluorocarboxylic acids
(Science 377; 19 August 2022)

Fluorine chemistry

- PFPE – PerFluoroPolyEthylen
 - Excellent lubrication properties
 - Temperature stable >300°C
 - Clear transparent liquid
 - non smelling
 - H1 with unintentionally direct food contact (some PFPE grades)
 - Persistent, bioaccumulative
 - Not biodegradable

Unique properties

- Transparent, clear, odorless
- Extremely wide temperature range -80°C up to +320°C, short time even +360°C
- Wide viscosity range
- Minimal surface tension -> good wetting
- High viscosity index
- Extremely stable against oxidation, no flash point
- Very high pressure-viscosity coefficient
- Broad material compatibility with nearly all elastomers and polymers
- Non migrating
- Low vapor pressure

Fluorine chemistry

- PTFE – PolyTetraFluoroEthylen
 - Used as a thickener or additive in grease formulations and coatings
 - Temperature stable until 280°C
 - White powder
 - non smelling
 - H1 with unintentionally direct food contact (some PTFE grades)
 - Compliance with EU regulation 1907/2006 (REACH) used PTFE has a content of <25 ppb PFOA
 - Persistent, bioaccumulative
 - Not biodegradable

Applications of PFAS products

- Oils and thickener in lubricants
- Dry Film coatings
- Food packaging
- Carpet and fabric
- Pots and pans
- Clothing
- Cardboard packaging
- Firefighting foams

Nanoparticles in lubricants

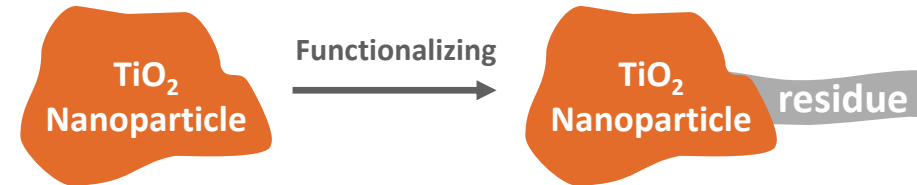
- Extreme pressure EP and anti wear improvers AW
- Graphene
- Carbon tubes
- CuO
- MoS₂
- BN
- SiO₂
- TiO₂

TiO₂ – Uses (Industrial)

- Wall paint
- Shampoos
- Toothpaste
- Skin care products
- Food additive E171

TiO₂ – Uses (Non-Industrial)

Surface-modified nano-particles



Investigation in lubricants:

@ additive concentrations: can indeed increase load-carrying ability and decrease the coefficient of friction (CoF)

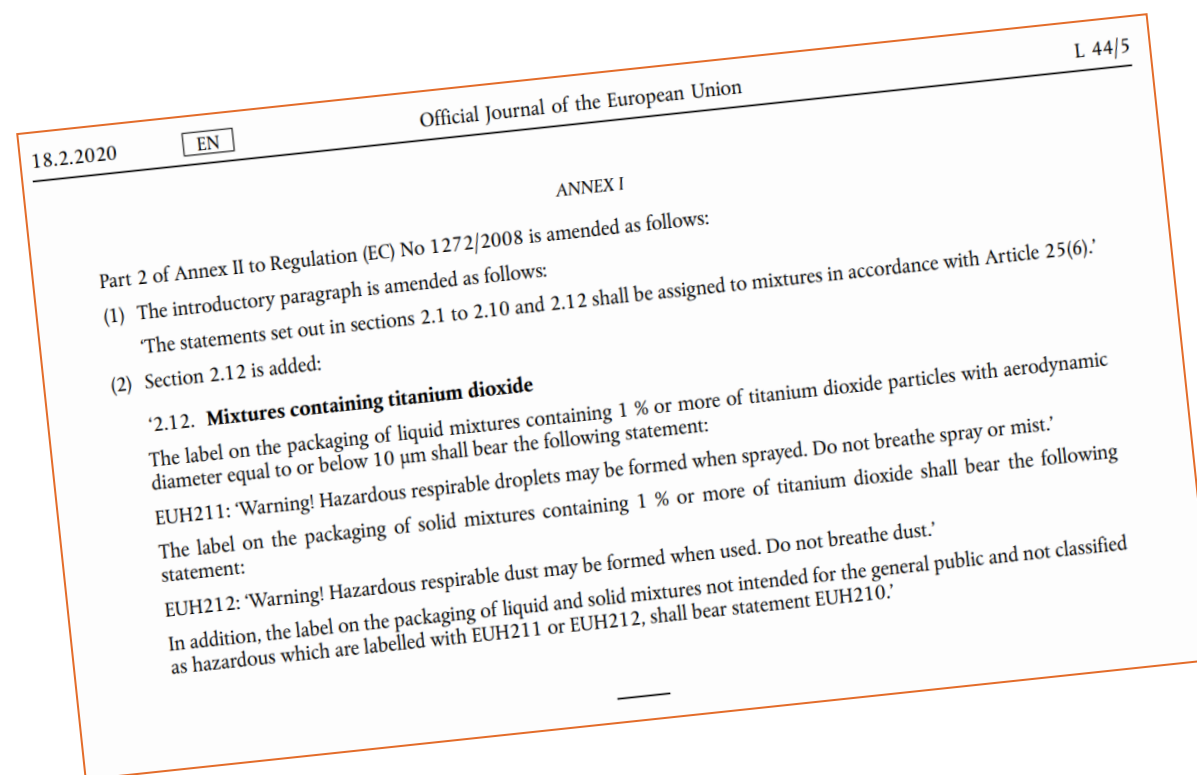
@ higher concentrations: agglomeration that results in abrasive behavior

- prevention of agglomeration essential
- surface modification essential

TiO₂ – Regulatory Changes in the Last Years

New classification of TiO₂ in form of particles with an aerodynamic diameter $\leq 10 \mu\text{m}$ as a "probably carcinogenic substance of category 2 by inhalation" by the EU at the beginning of 2020

- Products containing >1% of these type of TiO₂ pigments were forced to stricter regulation



Open for discussion

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All data are based on empirically determined values or on guideline values taken from technical literature.

Depending on the type of mechanical, dynamical chemical and thermal stress lubricants change their technical values. These values may affect the function of components.

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