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Synopsis Technical Papers

2025 ELGI AGM

Copenhagen Denmark

Do Androids Dream of Electric Grease

Author: Erik Willett – Functional Products

Erik Willett is president of Functional Products Inc., a US-based additive company. He has previously been awarded the NLGI Author Award and Award of Educational Excellence. Erik received his PhD degree in polymer science from the University of Akron.

Synopsis

This study compares the knowledge of a generalist AI model like ChatGPT versus a specialist AI trained in the grease industry's body of knowledge on the topics of formulating, manufacturing, selection and field applications. Can a generalist AI model pass an industry examination like the STLE CLS or NLGI CLGS? Or, does the industry require specialist AI models trained on the body of knowledge?

The Use of AI in Grease Research. Experimental Design for Optimising the Torque Reduction of Bearing Grease.

Author: Stefan Daegling
Co-Authors: Edward Worthington, Alan Wheatley.
Shell Global Solutions

While studying and after his bachelor degree, Stefan Daegling worked in several different chemical industries as an analytical scientist. He entered the lubrication industry in 1988. He worked for Deutsche Shell at different locations and in different functions. For the last 30 years, Stefan was a senior project leader in the area of lubricating grease development. He is the owner of several patents in this space and has delivered papers and publications.

Synopsis

Experimental Design (DoE) has been used for a very long time. Nevertheless, it can still be seen as Artificial Intelligence (AI) because it uses data from its study to see trends which are not obvious. Modern versions of DoE can be more complicated as the results are assessed by computer programmes and, therefore, can be seen as AI.

The project to be shown in this presentation was for an optimised, low friction/torque grease for automotive wheel bearings. A bearing rig test was used to measure the torque using a large range of grease formulation concepts in ball bearings. After three experimental stages the DoE software calculated an optimal and realistic grease formulation, which showed a significantly lower torque than two currently used greases for this application.

This presentation will show the design of the bearing test rig, the basic concept of Experimental Design, the different, potential, torque reducing concepts and their results. Some concepts which were expected to give significant torque reduction gave less good results. Others gave better results than expected. This will also be discussed based on the real requirements of the ball bearing application.

This should be interesting and useful for a wide audience. It will show effects of grease formulation, rig testing, ball bearing lubrication and the statistical power of Experimental Design

AI and the Grease Matrix

Author: George S. Dodos - Eldon's S.A.
Co-Authors: Raj Shah and William Chen - Koehler Instruments Inc.

Dr. George S. Dodos has a PhD degree and a Diploma in Chemical Engineering from the National Technical University of Athens in Greece. He is working with ELDON'S S.A. in research and development of new innovative products and sustainable lubrication solutions. He is an Adjunct Professor at UNIWA and ASPETE Universities in Greece teaching the courses of Fuels & Lubricants Technology, Applied Thermodynamics, Modern Vehicle Technology and Engineering Statistics and Measurements. He also holds a Research Associate position in the Laboratory of Fuel Technology and Lubricants in the National Technical University of Athens with his research activities focusing on sustainable and biobased fuels and lubricants. He has more than 100 publications in international peer-reviewed journals and conference proceedings on topics related to conventional and biobased lubricants and fuels. George has received the ELGI AGM Best Paper Award three times (2014, 2016, 2019) as well as the NLGI Author Award – Application (2017), the CLGI Best Paper Award (2021) and the NLGI-IC Award (2025). He is also a session organizer in the SAE Fuels and Lubricants Committee and the SAE Sustainable Mobility Committee. He is affiliated to several international organizations including ELGI, STLE, ASTM, SAE, ACS and IBBS. He chairs the joint ELGI/NLGI Biobased Greases WG and the End-of-Life TF in the ELGI STC.

Dr. Raj Shah has dedicated over 30 years to advancing innovation in greases, fuels, lubricants, and materials science. As a Director at Koehler Instrument Company in New York, he has played a key role in developing testing technologies that support industry standards worldwide. Recently honoured with the ASTM Award of Merit (its highest honour), his contributions span tribology, petroleum engineering, and chemical analysis.
Recognised by his peers for his expertise, Dr. Shah has been elected a Fellow of a dozen distinguished professional organisations, including the Society of Tribologists and Lubrication Engineers (STLE), the Institute of Chemical Engineers (IChemE), the American Oil Chemists Society (AOCS), the Energy Institute (EI), the Royal Society of Chemistry (RSC), the Institute of Physics (IOP), the American Institute of Chemists (AIC), the Institute of Measurement and Control (InstMC), the Chartered Management Institute (CMI), the National Lubricating Grease Institute (NLGI), and ASTM International.
Dr. Shah holds a Ph.D. in Chemical Engineering from The Pennsylvania State University and is a Chartered Engineer (Engineering Council, UK), Chartered Petroleum Engineer (Energy Institute), and Chartered Scientist (Science Council). He has also been recognised as an Eminent Engineer by Tau Beta Pi, the oldest engineering honour society in the United States.

Beyond his industry work, Dr. Shah remains committed to education and mentorship. He serves on advisory boards of Auburn University, Stony Brook University, SUNY Farmingdale, and Penn State University, supporting programmes in engineering and tribology. As an Adjunct Professor for the last decade at State University of New York, Stony Brook, Department of Materials Science and Chemical Engineering, he shares his knowledge with students and future professionals. Dr. Shah is the recipient of numerous ASTM, STLE and NLGI awards and served on the NLGI board of directors for over a decade.
With over 700 publications and decades of experience, Dr. Shah continues to contribute to industry standards and technological advancements. He remains currently actively involved on advisory boards at professional societies, collaborating with colleagues to drive progress in science and engineering.

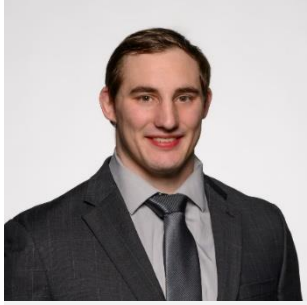
Synopsis

The integration of artificial intelligence (AI) in greases is changing the lubricant industry by optimising formulation, performance prediction, and real-time monitoring. This paper reviews the application of AI models such as artificial neural networks (ANNs), fuzzy logic, and convolutional neural networks (CNNs) in grease formulation and testing. These models are critical in addressing emerging challenges within the industry, such as the increasing reliance on synthetic oils, particularly in electric and hybrid vehicles, which demand greases capable of withstanding extreme temperatures and reducing wear under diverse conditions. AI enhances the efficiency of developing formulations, especially with the growing emphasis on sustainability, as bio-based lubricants gain attraction due to environmental regulations. Furthermore, AI's ability to predict wear patterns and optimise maintenance schedules helps mitigate the costs associated with machine downtime, thus meeting the modern industry's push for fuel efficiency, lower emissions, and extended operational lifespans. By leveraging AI, companies are innovating more resilient and eco-friendly greases that align with the industry's shift toward sustainability and synthetic lubricants

Application of Artificial Intelligence (AI) to Lubricating Grease Formulation

Author: Gareth Fish
Co-Author: Devon McCune
Lubrizol Corporation

Dr. Gareth Fish PhD DIC BSc (Hons) ARCS CSci CChem MRSC MEI CLS CLGS is a Technical Fellow at the Lubrizol Corporation, Wickliffe, Ohio. He holds a PhD in tribology from Imperial College, London, and has more than 35 years grease industry experience. He is an internationally recognised, multiple (x20) award-winning author of more than 90 technical papers including 18 ELGI papers. He is a member of the NLGI Board of Directors and chair of the NLGI Basic Grease Course. He was 2020's recipient of the NLGI Award for Achievement. He is an NLGI Certified Lubricating Grease Specialist (CLGS), a Chartered Scientist and STLE Fellow and Certified Lubrication Specialist (CLS). He is active within ASTM, sitting or chairing multiple committees related to grease and tribology. He previously worked at UK Ministry of Defence and GKN Automotive in UK and USA.



Devon K. McCune BS CLGS has a BS degree in BioMolecular Engineering from the Milwaukee School of Engineering. He's been in the grease industry for 4 years. His grease career began at Chemtool 2020 where he worked as a research and development chemist before joining the grease team at the Lubrizol Corporation in 2021 as a research and development chemist. In 2024 he passed the NLGI Certified Lubricating Grease Specialist (CLGS) examination.

Synopsis

This paper will look at the application of AI to grease formulation and how an experienced grease formulator is today much better than AI. The lubricating grease industry has evolved over the last 150 years largely through Edisonian development techniques. In the 1990s, design of experiment (DoE) techniques were introduced and, more recently, computer prediction models have eliminated a significant amount of tedious laboratory work in determining base oil blends. Recently Artificial Intelligence (AI) has been perceived to be the next breakthrough technology impacting the developed world. It has been widely reported that AI will take away the jobs of scientists and engineers and many other professions. By inputting information about the application for the lubricating grease, it has been suggested that the AI chatbot will be able to develop the complete formulation and manufacturing protocols for the required grease. The AI will predict the test results and as a result the 30+ experienced formulator will be replaced by a computer chatbot. This means the experienced formulators will no longer have employment.

However, this concept has several flaws when put into practice. This paper will cover some examples of lubricating grease development and show how DoE and computer models have a place in the development laboratory but there is still a lot for AI to learn about the formulating, manufacturing, and testing of lubricating greases.

SiToLub - Simulation Tools for the Design of Safe and Sustainable Lubricants

Author: Ben Fry – R.S.Clare & Co.Ltd
Co Author: SiToLub Consortium - https://sitolub.eu

Dr Ben Fry is a grease development chemist at RS Clare & Co Ltd. He received a PhD in tribology from Imperial College, London in 2020 studying the friction reducing mechanism of lubricant additives. Since joining RS Clare he has been involved in developing greases for a variety of different applications and is the lead participant for RS Clare on the SiToLub project.

Synopsis

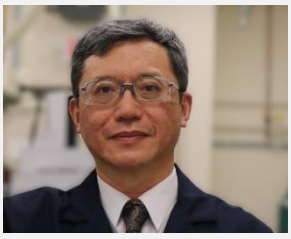
The need to promote a low carbon economy while ensuring effective actions to overcome the obstacles that the lubricant companies are facing (e.g. ever-changing regulatory restrictions on the chemicals, more demanding technical requirements of the industry, etc.) has led to the need for using computational models to accelerate the time to market of novel lubricant formulations. So far, each modelling case has been focused on understanding properties under specific conditions. The SiToLub project, funded under the HORIZON-CL4-2023-RESILIENCE-01 topic, aims at creating an integrated, multi-functional, digital simulation environment, supported by artificial intelligence. It will help the lubricant manufacturers and industrial lubricant users to face these challenges and move towards Safe-and-Sustainable-by-design (SSbD) materials and products by pre-assessing lubricant formulations at the design phase. SiToLub will integrate tools to predict human and environmental toxicity, product carbon footprint (PCF) and lifecycle analysis (LCA), and to simulate properties and the interactions within the application environment, to estimate life-time product performance and efficiency during use phase of the new formulations. This paper will address the aims of SiToLub, suggesting how this tool will be used to speed up and improve the formulation of new greases and lubricants and show some initial results from the different models

A detailed study of current and future antioxidant systems using CSC grease

Author: Wayne Mackwood
Co-Authors: Jesse Allan; Huiyuan Chen and Ravichandranath Singathi,
LANXESS Corporation Canada & USA

Wayne Mackwood is currently the Global Head of Detergent and Grease Technology for LANXESS, leading a highly skilled, dynamic, and dedicated team of chemists at its West Hill, Canada Application Technology Centre. He is currently serving as the President of the National Lubricating Grease Institute (NLGI) for 2024-2026. He is a recognised expert in the design, manufacture and use of Calcium Sulfonate Complex Grease and has developed over 150 grease formulations for use in a broad range of applications. He is also active in the introduction and development of new detergent technology and formulations for lubrication, corrosion inhibition, and grease manufacture. Wayne has spent much of his 30+ year career as a scientist but has also held roles in marketing and asset management. He has authored more than a dozen technical papers, contributed to numerous journal articles, holds two patents, and has given more than 20 presentations at leading conferences and seminars around the world. He has a Masters in Materials Engineering Science, with a focus on Tribology, from the University of Western Ontario. Wayne has been a member of the NLGI Board since 2011 and has served on the executive committee since 2018. He has been active in the Toronto STLE since 1995 and served on the STLE Board of Directors from 2008 - 2011. He has been awarded the NLGI John A. Bellanti Sr. Memorial Award in 2019, the NLGI Golden Grease Gun in 2021, the NLGI Award for Educational Excellence in 2022, and the NLGI Fellows Award in 2023. In November 2023, he was awarded the LANXESS Robert W. Brown award for his technical contributions over his career at LANXESS.

Jesse Allan is currently an R&D Chemist for LANXESS, working as a key member of the Grease and Detergent Technology team at the West Hill, Canada, Application Technology Centre. Although he has only been in the industry for the last six years, Jesse has assisted in developing over 40 Calcium Sulfonate Complex Grease formulations that have found uses in a wide range of applications, including both food-grade and industrial settings. He actively collaborates with chemists, both in the lab and on-site, to introduce new chemistries to the grease, such as antioxidants, corrosion inhibition, and extreme pressure additives. Jesse works closely with plant engineers to ensure the grease is manufactured to the highest quality standards and assists in troubleshooting when required. Additionally, he has delivered presentations on new developments in Calcium Sulfonate Complex Grease, both internally at LANXESS and externally with customers, participating in public seminars and conferences. Jesse has also increased his involvement in the industry by serving on the STLE Toronto Board, volunteering at NLGI, and attending local chapter seminars and presentations whenever they are available.



Huiyuan Chen is currently a Senior Scientist for LANXESS, working in the lubricant additive product and process development team located at Nudenberg-Wheeler Technical Center, in Naugatuck, Connecticut, USA. In his 25-year career at LANXESS and its legacy companies, he has worked mostly in the areas of manufacturing process improvement, product quality improvement, manufacturing troubleshooting, and functional testing of aminic antioxidant additives. In recent years, he has served as the leading scientist for the antioxidant product and process technology and provides technical support for product management, marketing, sales, manufacturing, customer service, purchasing, and regulatory affairs representatives. He is the key inventor of new, safe and environmentally friendly aminic antioxidants and actively collaborates with colleagues to explore the applications of safer antioxidants in a variety of lubricating oils. He is an active STLE member and was interviewed as an expert in antioxidant additive technology by TLT magazine in May 2023. He is a contributing author of technical presentations and scientific papers published in Science, JACS, Angewandte Chemie, and Encyclopedia of Reagents of Organic Synthesis, etc. He also holds three granted patents, one pending patent, and one published patent.

Ravichandranath Singathi is currently working as Senior Research Chemist in the product and process development team for LANXESS-Lubricant Additive Business Unit at Nudenberg-Wheeler Technical Center, Naugatuck, Connecticut, USA. Ravi is working mostly in the areas of product and process improvement, manufacturing troubleshooting, and functional testing of aminic antioxidant additives. In recent years, he played an important role in the next-generation antioxidant product and process technology and provides technical support for product management, manufacturing, customer service, and regulatory affairs representatives. Ravi works closely with the application technology team and actively collaborates with the technical team for newer safe and environmentally friendly aminic antioxidants Apart from antioxidant product development, Ravi handles other research projects and products of class organic antiwear, friction modifiers, and battery electrolyte additives. He is an active STLE member and reviewer of MDPI *Polymers and Elsevier* journals.

Synopsis

- Current and novel antioxidants and their function in a grease
- Oxidation test methods and the effect of AO treat
- The effect of calcium sulfonate complex (CSC) grease thickener on antioxidant performance versus oil alone

Antioxidants are critical for the longevity of today's modern lubricants. Recent and ongoing regulatory changes in the core antioxidant technology for grease is leading to uncertainty in the marketspace. Many formulators rely upon their tried-and-true systems and may not be familiar with what may be available to them. Therefore, it is a good time to take a comprehensive look at the technology currently available to the grease formulator to prepare for the future. This study sets out to examine a broad range of antioxidant technologies including those suited for industrial as well as H-1 grease. Calcium sulfonate complex (CSC) grease is used as the basis for the study and the antioxidant selection includes new technology being developed to meet the changing regulatory landscape. It examines the effect of antioxidant chemistry and treatment on grease made with Groups I, II and IV base oils. It utilises and examines the various tests available for performance characterisation including PDSC, RapidOxy™, simple Oven Panel, as well as selected PVOT and FE9 testing. In addition, the study will examine the same antioxidants and treats in the base oil systems alone, to understand what effect, if any, the CSC thickener has on antioxidant efficiencies. The work will show potential options available in the future for oxidation protection of grease, including several new technologies currently in development.

The PFAS restriction - a new challenge for lubricant producers

Author: Axel Figge - Bechem

PhD in organic chemistry in 2005 at the University of Wuppertal. After a short time continuing the work at the University, he became, from 2006 to 2008, a group leader at Taros Chemicals in Dortmund. Since 2008 he has been with Bechem as group leader R&D Greases, meanwhile becoming Head of R&D Special Lubricants.

Synopsis

Lubricant manufacturers are facing a major challenge with the EU's proposed restriction on PFAS, a group of chemicals vital for high-performance lubricants due to their thermal stability and low friction properties. This regulation impacts thousands of PFAS types, making it difficult for producers to find alternatives that match the performance required in industries like automotive and heavy-duty machinery. While the restriction requires extensive R&D and collaboration to ensure safe, effective replacements, it also opens doors to developing more sustainable lubricant solutions.

The green blade-adjustment mystery

Author: Roland Ardai - Axel Christiernsson

Roland Ardai joined Axel Christiernsson International AB in 2014 as a product development engineer, mainly focusing on renewable and biodegradable products. He previously worked for MOL-LUB Ltd in Hungary as a product development engineer of greases, mould release agents and corrosion inhibitors, product line manager of greases and REACH expert. Before that, he worked for the Finnish Perlos as a process development engineer. He has MSc diploma in chemical engineering and BSc in economical engineering from the University of Pannonia.

Synopsis

Wind energy is a cornerstone of the transition efforts for a sustainable energy mix in the future. To optimise the conversion of the wind's kinetic energy into electricity, the wind turbine must be able to adapt to various wind speeds. Pitch bearings are the connecting elements between the rotor hub and the rotor blade of a wind turbine. The pitch angle is an adjustable parameter to deal with this variable. These bearings deal with high loads continuously and with various wear mechanisms, but they must serve as long as possible due to the obvious maintenance and replacement difficulties. With modern individual pitch control, the adjustment has become even more aggressive, resulting in contacts that are challenging to lubricate, placing great demands on the pitch-bearing greases.

Wind turbine farms can be in natural, agricultural and industrial areas where suitable wind conditions exist. Offshore wind farms today make up around one-third of new installations and the share is growing. Loss of lubricant in natural habitats that present high levels of vulnerability must be avoided. This paper is a feasibility study of making a pitch-bearing grease with as little environmental impact as possible, while offering high performance in the application under a wide range of conditions. The grease has been verified in oscillating bearing contacts under pitch-bearing conditions and benchmarked against current pitch-bearing greases on the market. Here we present an EAL pitch-bearing grease that can lubricate the pitch bearings and protect them from damage all year round in all climates.

No Free Lithium
Subtitle: Make lithium grease with <0.1% 'free lithium' using a pre-formed thickener

Author: Howard Kennedy
Co-Authors Steven Lu and Victoria Dameski
HL Blachford Ltd.

Howard is a farmer by background with a BSc and MBA from Guelph and York Universities in Canada. He has spent the last 30 years of his career developing products and business in various areas of the chemical world including coatings, plastics, pigments and lubricants.

Victoria Dameski earned her Bachelor of Science degree in Chemistry from Trent University in Canada. There she focused on various areas of chemistry such as spectroscopy, mass spectroscopy, chromatography, organic chemistry, inorganic chemistry, physical chemistry, and environmental chemistry. For the last 3 years, Victoria has been working for H.L. Blachford doing research and process optimisation of various stearate chemistries including lithium, calcium, zinc, manganese and sodium

Steven Lu obtained a Bachelor Degree in Chemical Engineering at Zhengzhou University, China, and his PhD at Loughborough University, UK. He has worked in China, UK and Canada for over 40 years in Research and Development and at HL Blachford since 2007 as a formulator in the area of metallic stearic product development and process optimisation. The metal stearates include lithium, lithium 12OH, calcium, calcium 12OH, zinc, manganese, aluminium, sodium and potassium as well as aqueous stearate dispersions. Applications include lubricants, mould release agents and stabilisers in plastics, rubber, grease and powdered metals

Synopsis

This paper investigates how lithium grease can be manufactured with <0.1% 'free lithium' using a pre-formed thickener (soap) in order to comply with potential EU and US regulatory requirements. A review of the reasons behind the concern over the presence of lithium and the status of the potential regulatory changes will be covered. A comparison of the manufacturing methods for lithium grease using the standard in-situ process and the pre-formed soap process will be made. As well, the basic manufacturing process for the pre-formed lithium soap will be shown. This study investigates the test methodologies used to calculate free alkalinity (lithium hydroxide), which allows the detection of free lithium content in a pre-formed thickener, and therefore, the prediction of how much 'free lithium' is present in the grease. Chemical analysis completed via FTIR, DSC and ICP measuring the free fatty acid (FFA), free alkalinity, free lithium hydroxide and total lithium content will be shown. A review of approximately 30 years of data will show that the pre-formed lithium thickener has typical FFA at 0.15%; free lithium hydroxide at 0.07%; total lithium content at 2.25% and moisture content at 0.28%. The conclusion will be made that if a pre-formed soap is used to make grease at a level of 10%, the amount of 'free lithium will be approximately 0.007% which is far below the 0.3% or 0.1% potential regulatory limits.

The implementation of Artificial Intelligence (AI) in Grease formulation development and its marketing – a case study

Author: T. Singh*
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Dr Tarunendr Singh currently holds a position as Director – Business Development at Siddharth Grease & Lubes Pvt. Ltd. Dr Singh has been working in the field of greases and tribology for the past 38 years with research results reported in over 100 published papers. His research and service contributions have been recognised by multiple awards. He has extensive knowledge and experience in lubricants and greases.

Dr Singh obtained his Ph.D. in Applied Chemistry with focus on Extreme Pressure Lubricant Additives from the Indian Institute of Technology, BHU, Varanasi in 1990. He also obtained his B.Sc. & M.Sc. in Chemistry, MBA in Marketing and UG Diploma in German Language.

He is associated with the NLGI-India Chapter since its inception in 1997. Currently he is serving as Sr. Vice President of NLGI-IC. He was conferred with Lifetime Achievement and Long Service Awards from NLGI-IC for his immense contribution to the grease industry.

He is also active in the Tribology Society of India, currently holding the position of Joint Secretary.

He is convener of the committee for framing the Indian Grease Standards on behalf of the Bureau of Indian Standards. In the recent past he has made specifications for ISO-2137.

Dr Singh is a recipient of a 2024 NLGI Golden Grease Gun Award for his valuable work in the development of grease technology, manufacturing, testing, applications and better understanding of grease behaviour for the promotion of grease usage. He always believes in building long term professional and personal relationships that bring value and last a lifetime.

Synopsis

Artificial Intelligence (AI) is a set of technologies that enable computers to perform advanced functions, including the ability to see, understand and analyse data / deep learning, provide more insight / findings / recommendations quickly. AI uses different kinds of training models: supervised learning, unsupervised learning and reinforcement learning until the output results reach a desirable range.

The Artificial Neural Network (ANN) framework(s) are being used to analyse the input data and predict the output parameters. These frameworks are being used throughout the value chain of the grease business: formulation development, raw material sourcing, production planning, manufacturing of grease, customer management, maintenance, etc. Steps have already been taken to implement AI tools in some of these areas at the author's organisation.

This paper covers in detail the implementation of AI tools in formulation development and marketing management areas. ANN software is being used for mapping different AW, EP and MDA additives in greases for predicting desired WSD, weld load and copper corrosion properties. The AI tool is also implemented to streamline grease marketing activities. Its usage boosted customer engagement and enhanced decision-making. Features like predictive lead scoring and automated support provided reduction in response time and enhances overall productivity. It has reduced cycle time for formulation development and improved our efficiency for sustainable business growth.

AI 2025: Building blocks for Future Potential for SMEs in the Lubricants Industry

Author: Sofia Öberg – 2Probity

Co-Author: Sofia Magnusson - Consultant in quality and environmental management

Sofia Öberg holds an MSc in Environmental Science from the University of Gothenburg. She now specialises in regulatory compliance and standards linked to the environment, quality, health and safety as well as traceability and food. She is a lead auditor and has experience from many different industries after over 20 years in the field. She is also involved in the ELGI's working groups focusing on food lubricants, sustainability and regulations. She brings extensive experience in assisting SMEs in managing complex regulatory environments.

Sofia Magnusson is a consultant specialising in digital and business strategies, quality and environmental management. She has deep expertise in digital transformation and generative AI. She supports SMEs in optimising operations, strengthening competitiveness, and successfully integrating AI-driven solutions into their businesses. With a great understanding of businesses in different phases she combines the knowledge and possibilities with AI.

Synopsis

We explore how Small and Medium Enterprises (SMEs) in the lubricants industry can harness the power of Generative AI today to prepare for the competitive landscape. We'll focus on practical applications, with a particular emphasis on navigating complex regulatory environments and managing industry-specific information and demystifying AI for SMEs in the lubricants industry. Also we'll provide a roadmap for leveraging AI to enhance competitiveness going forward.

Key areas of exploration:

Mastering regulatory complexities with AI: How to use AI tools to interpret complex regulations, ensure compliance, and produce regulatory documentation.
AI-powered information management: Exploring how AI can process and analyse vast amounts of industry-specific literature, research papers, and technical documents, turning information overload into a competitive advantage.
Enhancing customer communication: Utilising AI to create clear, consistent, and tailored communication materials, from technical datasheets, sustainability reporting to marketing content.
AI in product development research: How AI can assist in literature reviews, patent searches, and trend analysis, potentially accelerating the innovation process for SMEs with limited R&D resources.
Ensuring secure AI tool usage: Discussion around the best practice of cybersecurity to minimise the risk of exposing businesses to data breaches while fostering a culture of responsible AI usage.

Bioderived EAL Overbased Calcium Sulphonate Greases

Author: Ulf Gardenier
Co-Authors: Markus John; Martin Maass; Dieter Grobler
KAJO GmbH

Ulf Gardenier is 55 years old and lives with his wife in Düsseldorf, Germany. In the 1990s he studied physics and business administration at the University of Aachen, completing his two courses with diploma theses on laser-optics and maintenance processes on freight-cars. Meanwhile, Ulf looks back on a 25-year journey in the consultancy area. He started his career at SIEMENS as an SAP consultant in the growing tide of business process-driven projects of large industrial companies motivated by the year 2000. Later, as a key account manager, he was responsible for his company's business with several global customers.
In early 2022, Ulf decided to completely change his previous career path and joined KAJO, a German manufacturer of lubricating greases and oils. The challenge of entering the North American market with new innovative products was the main motivation for this move. He now heads KAJO North America Inc. located in Charlotte as managing director.

Synopsis

The 2024 ELGI motto was an evaluation of what a road away from Lithium could look like. One potential solution is a Calcium Sulphonate thickened, high performance EAL lubricant. The goal was to establish a new technological platform for various EAL grease formulations.
The challenges for manufacturing a mineral oil-free overbased Calcium Sulphonate are presented. An example being the use of CO_2 as a raw material with bio-derived esters, and the enhancement of the classic grease production by a pre-stage for producing the overbased Calcium Sulphonate.
PCF calculations are still messy because of the lack of misleading or big differences in data, depending on how you analyse your system. Looking at emission hot spots helps to create quick qualitative statements regarding improvements compared to previous results and mineral oil-based grease designs. Environmental safety with EU Ecolabel certification and VGP compliance is ensured.
Different grease versions and formulations are tested or are in tests. Application characteristics and challenges are going to be discussed. The test results of the different grease formulations are reviewed for some ideal applications in the areas of mining, marine, construction, rail, and cement.

A review of the benefits of wave-based heating of processing speciality products”

Author: Lou A. Honary, President

Lou Honary, formerly president of Environmental Lubricants Manufacturing, Inc., is currently president of WAVEtek Process Technology, LLC. Dr. Honary is a world-renowned advocate for the use of electromagnetic waves for manipulation of material molecules to achieve a desired process outcome. He has 12 patents and one pending patent dealing with biobased lubricants, transformer oils, and microwave-based grease processing. A passionate advocate for newer, safer and more sustainable technologies, Dr. Honary is a prolific publisher of journal articles and regularly presents at national and international conferences. He is the author of a book on biobased lubricants, several book chapters, as well as numerous publications and invited presentations. Dr. Honary is the recipient of the 2020 Fellows Award by the National Lubricating Grease Institute (NLGI).

Synopsis

The use of wave-based processing, including microwaves for processing grease and lubricants, has been presented in earlier ELGI meetings. This presentation will cover the range of electromagnetic spectra that are in use for operations that require heating or pinpoint chemical reactions. But, more specifically, it focuses on the benefits of wave-based processing in applications beyond grease manufacturing. Those include food processing, recycling, sterilisation, industrial drying, polymerisation and esterification.
In addition to more effective heating, the products that are heated by electromagnetic waves are rarely exposed to hotspots of conventional heating vessels, resulting in less oxidative damage to the end product. The concepts present potential for production of more economical products across a broad range of applications. Combined with catalysts and nano particles, wave-based heating can deliver targeted reactions by careful attenuation of the waves to the dielectric property of target molecules. The presentation is designed to explain the theory as well as practical uses of wave-based processing and encourage development of newer processing techniques.

Bottlenecks to AI in tribology testing: Test efficiency and how to improve it

Author: Dirk Drees
Co-Authors: Lais Lopes, Michael Anderson, Pedro Baião
Falex Tribology & Falex Corporation

Dirk Drees, the CEO of Falex Tribology NV, graduated as Materials Engineer and received a Ph.D. degree (1997) from the Materials Engineering Department of the Catholic University of Leuven on tribo-corrosion of thin coatings. Since 1999 he is leading Falex Tribology and built up the testing and support activities in Europe. Today it is an international tribological consulting and testing facility for industry and research centres. He has managed 8 European and some national funded innovation projects in the fields of advanced materials, processing and nano technologies, always with an emphasis on the introduction of new materials and technologies in industry. He is author or co-author of 30+ scientific publications, and author/co-author of 4 test book chapters on tribology. His main focus is on translating industrial issues to sound lab-based test programmes.

Synopsis

AI offers great opportunities in research and quality control, when these systems of 'machine learning' are unleashed on vast amounts of data. Certainly, AI systems can discover patterns more efficiently that human investigators and can be a great aid to development, but also to condition monitoring opportunities.

In our field of conventional tribology testing, a lot of attempts have already been made to employ AI technologies and the amount of conference sessions that have 'AI' in their title has grown exponentially in the past 2 years. It's the latest buzz word in tribology, after 'nano' and 'sustainability'. But how far are we really, with machine learning methods in our tribology lab? When speaking with AI specialists, the recurring question is: we need training data... To train a neural network, a minimum of data is necessary, and although they tell us that it's 'less data than you would expect', the reality is that we don't produce nearly enough qualified data yet to train networks.

In part, this is because tribological tests cost a lot. They cost time (operators, analysts), machine hours (expensive mechanical equipment with maintenance costs), transportation costs (of test samples and test specimens), materials (samples and test specimens)..Contrary to Amazon, Google, Facebook who harvest their data almost for free from their many willing suppliers (i.e. the users of their free services), in the tribology field we have to expend great efforts to generate quality data.
One of our projects in the past has been a way to multiply wear tests by a parallel test approach (short ref), a methodology that we have also used for grease anti-wear testing. Although the method wasn't picked up yet (because it's not an ASTM standard), this is one way of multiplying the data result without multiplying the time and cost.
But there are other ways too. This paper does not demonstrate AI potentials in diagrams or theoretical explanations, but looks at ways to make existing test methods more efficient so they generate more and better quality data on behalf of AI programmers

Kill the Intermediary: Populating a Tribology Database straight from the Tribometer

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Synopsis

Modern machine learning techniques thrive on large volumes of data to identify patterns and make predictions. The absence of a unified tribology database leads to inefficiencies in research and development, hindering the understanding of fundamental mechanisms and making one-to-one comparisons impossible.
i-TRIBOMAT: The European Tribology Centre has spent the last four years developing a comprehensive online database for materials (e.g., lubricants), and tribology-related datasets. One positive outcome is that testing becomes more organised when there is awareness that the data will be stored for future use. An urgent need for standardising practices in tribology has emerged as a key lesson from this collaborative effort.
Another lesson learned is that uploading data to the cloud can be tedious. Properly organising the data requires considerable time and effort, and both operators and scientists often struggle to see the value in this process. The proposed approach involves connecting tribometers to a centralised tribology database. This direct link between machine testing settings and readings not only saves time but also helps eliminate human errors and standardises post-processing practices.
By ensuring a seamless connection between tribometers and the European Tribology Centre databases, we streamline access to diverse datasets, which is a necessary step for AI-driven advancements in the faster discovery of new materials, lubricants, and surface treatments.

Using AI and Machine Learning to enhance Condition Monitoring of In-service Greases

Author: Rich Wurzbach – 1-MRG Labs 2-Invicta Labs 3-Clevr

Rich Wurzbach has over 30 years of experience in the development of Condition-Based Maintenance programs. His past experience includes working at the Three Mile Island and Peach Bottom Nuclear Plants and the National Institutes of Health. He works as a tribology consultant for companies including Merck & US Army. He was on two research teams in Denmark studying lubrication and sampling practices for off-shore wind turbine components

Synopsis

Laboratories in Europe, Asia and North America have adopted technology for analysing in-service grease samples obtained with equipment and methods outlined in ASTM D7718 for In-service Grease Sampling, and analysed per ASTM D7918. This presentation will outline the repeatability and reproducibility obtained by adhering to these standards, and the effective application of Machine Learning algorithms, made possible by these robust sets in support of condition monitoring for critical grease lubricated assets.

Modular Production Systems for Smaller-Scale Grease Production - A Cost-Effective Building Block Set for Optimising Reach within a Dynamic Global Market

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Joe Sexton, is currently the Senior Lead Mechanical Engineer for STRATCO, Inc. Joe graduated from Texas A&M University in College Station, TX in 2013 with a B.S. in Mechanical Engineering. Prior to attending Texas A&M, he attended Stephen F. Austin State University in Nacogdoches, TX from 2008 through 2010, and was a member of the 2008 Lumberjack football team while studying pre-engineering. Joe was previously employed by Worley (previously Jacobs), a major Engineering, Procurement, and Construction (EPC) company, as a lead mechanical engineer based in Baton Rouge, LA from 2013 through 2021 with a focus on the Oil & Gas and Chemical industries. Joe joined STRATCO® in 2021 and is based remotely in Mont Belvieu, TX while STRATCO® home office is in Scottsdale, AZ. During Joe's experience he has engineered a variety of static and rotating equipment while leading the mechanical engineering team, composed of both domestic and foreign team members, to successful projects. He is a Licensed Profession Engineer and is a member of American Society of Mechanical Engineers (ASME).

Synopsis

Within the commercial grease industry, the historical focus with modular production systems has been centred on building, upgrading, and retrofitting large capacity production to maximise economies of scale in the global grease marketplace. While this approach has been financially beneficial for those grease products formulated for broad applications and heavily utilised by the global market, a large-scale production solution is not optimal for each facility, producer, product, and/or region. To meet the demands of the entire grease market, smaller-scale grease production offers producers an economically sound pathway to produce speciality, new, or low volume grease products worldwide, as well as to produce grease products at smaller facilities and/or in specific regions closest to the end-users. A LEGO® building block set-approach to smaller-scale grease production – whereby modules are assembled and customised in a variety of production schemes – appears to be the optimal way for grease producers of all sizes to maximise their reach within the global market. Using the 1 MT small commercial scale modular Grease Production System (GPSTM) from STRATCO® as an example, this paper will assess and demonstrate the financial benefits as well as the strategic benefits in employing smaller-scale modular production systems in the manufacture of lubricating grease