Key concepts

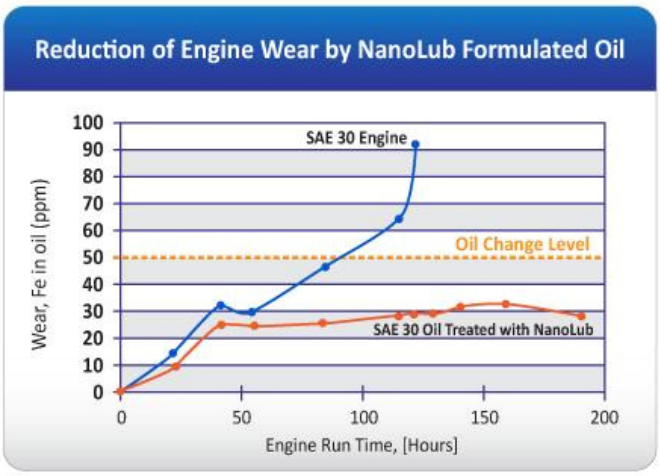
- *A new class of nanotechnology solutions has answered industry demand for advancements in lubrication*
- *The distinctive inorganic structure inherent to nanoparticle based additives ensures superior overall properties, while providing for both enhanced performance and decreased friction and wear even under extreme conditions.*
- *NanoLub is the world's first commercial nano-additive that reduces high load-level friction and wear.*

Anyone involved with the engineering industry and the use of advanced lubrication products has likely found themselves acutely aware of the many challenges involved. While the problems persisted for years, no innovative approach was taken to combat the relevant issues and thus the industry remained unchanged. Fortunately through a unique series of discoveries, a new class of nanotechnology solutions has brought a timely end to the long-enduring quest for lubricant advancement.

Overview

With added wear on engine structures an inevitable result of modern technology, alongside ensuing consumer demand, the need for a more sophisticated category of lubrication additive has arisen. Because friction accounts for a considerable portion of total power loss in internal combustion engines, new limitations have come to impose the design and development of reduced-friction engines. In turn, the quality of lubrication employed is directly linked to the frictional losses themselves. In recent years, these tougher regulations from industrial and governmental bodies have led to the search for alternative lubrication additives, as the result of both environmental and health factors. The necessity for government compliance and environmentally aware offerings is amplified with the continuing growth of the industrial sector and thus consumer demand for enhanced overall lubricant performance.

Lubricating additives such as graphite, boron nitrate, molybdenum disulfide (MoS_2) and tungsten disulfide (WS_2) in platelet, or layered crystal form, have long been used as solid lubricants and additives in a range of industrial applications as the result of their ability to reduce friction and wear.



Unfortunately the structure of traditional additives designed to reduce friction are not equally effective in terms of boosting performance, and thus the incorporation of a separate additive is often essential to achieve the necessary results. Conversely, micro-sized products that were designed to increase performance lacked the ability to create a tribofilm, an anti-friction and anti-wear protective film.

Furthermore, the lack of EP (extreme pressure) performance inherent in traditional additives only compounded the problem. The demand for a product which could combine these functional elements in a single lubrication additive became increasingly pronounced as relative industrial applications continued to evolve.

At CMPC Maderas Planta Bucalemu, the incorporation of NanoLub reduced 50 disarmament events in 2008 down to just four the following year.

Expanding on the need for a more sophisticated offering, many conventional lubricants typically contain substances such as zinc or calcium and are generally considered to be toxic. Synthetically-produced boron nitride, a standard contender in reducing friction and wear, was expensive and largely dismissed as a viable option. Boron nitride is furthermore reported to display weak fibrigenic activity and thought to cause the condition pneumoconiosis, an occupational lung disease. While conferring a high lubricity, MoS_2 cannot resist extreme temperatures and has furthermore been found to release free sulfur, a dangerous pollutant with highly corrosive properties.

The Emergence of Nanotechnology

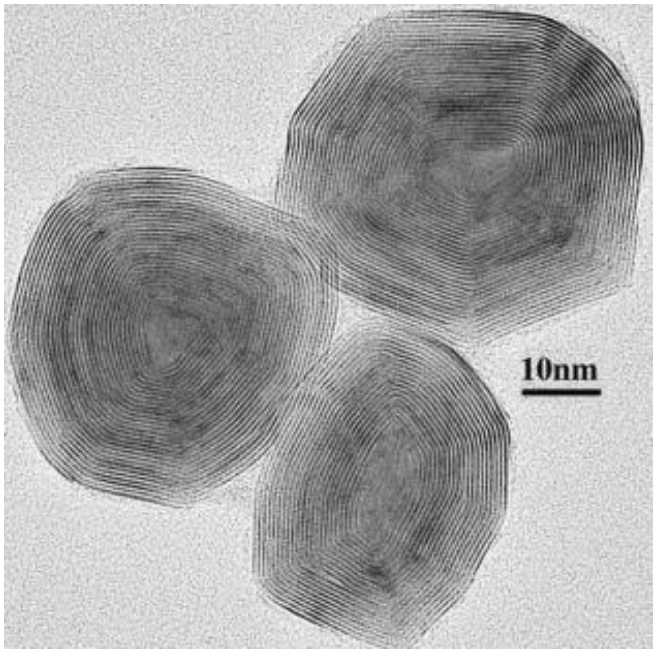
With the discovery of nanotechnology, the science of lubrication began to evolve. Currently a top industry focal point, nanotechnology involves structures formed through single atoms. Combined together one by one, the resulting structure ensures unique and superior overall properties.

The science of nanotechnology initially stemmed from the discovery of three-dimensional inorganic compounds, which could be recreated as "nano-size", multi-walled nanoparticles. The structure of these nanoparticles was such that they could penetrate the surface of an object, as opposed to the conventionally large, flat platelet of more traditional lubricants and additives.

Thanks to a wholly unique composition and chemical nature, such nanoparticles incorporate exceptional properties not found in traditional materials. The result of a distinctive inorganic structure, these new materials reduce wear and friction significantly more effectively than traditional lubricants and are ideal for any industrial application requiring advanced lubrication. Their appeal is widespread throughout the industry, as a single additive used in low concentrations could now be used to achieve maximum results, at a competitive price point.

"The results show that a significant increase in the operational life of rolling/sliding components can be achieved by using lubricants incorporating inorganic fullerene-like materials."

The rise of nanotechnology brought forth a new classification of innovative products to a field which had seemed destined to remain unchanged. Experts predict that the evolution of this unique technology and its continuing advancements will fundamentally alter the future of industrial lubrication.



NanoLub's Spherical, multi-walled structure is Nanosize, ϕ 80 – 230 nm

Important to note, however, is that not all nanotechnology lubricant manufacturers are created equal. As with any contract, research is an essential aspect of the process to ensure a secure joint venture with a trusted corporation which has a pre-established client base. An international support team and global manufacturing facility can be critical components of any effective partnership.

The Pinnacle of Performance: NanoLub

Although nanotechnology is not a new discovery, it was long considered too costly an option when measured against more affordable, conventional lubricants. More recently, however, the industry has accessed a significant breakthrough, allowing for the advanced technology to become available at a competitive price point with the evolution of NanoLub® RC-X.

The flagship product of NanoMaterials, a leading developer of nanotechnology products widely recognized for excellence in the field, the NanoLub additive is the world's first commercial lubricant that reduces high load-level friction and wear. Based on spherically-shaped inorganic nanoparticles, NanoLub was designed to address the efficiency requirements of automotive and generator engines. NanoLub is formulated to ensure both low friction and anti-wear properties at extreme pressures, negating the need for two separate additives and thus decreasing formulation cost. Moreover, NanoLub reduces noise and friction better than other additives, improves energy efficiency, decreases heat production, and improves power output.

By minimizing wear via a tenacious tribofilm, which remains intact even following an oil change, NanoLub ensures longer equipment life while also extending the maintenance interval. As an oil concentrate, it is specially formulated to avoid sedimentation and is readily mixed into a variety of host oils. With its uniquely strong structure, NanoLub provides excellent lubrication in applications ranging from machines and tooling to engines and bearings, and is available in units ranging from 250 ml bottles to 1,000 litter IBCs.

Lubricants which incorporate inorganic nanoparticles, such as NanoLub, will contribute to significantly reducing frictional losses and accordingly help vehicle manufacturers meet EU CO_2 emissions targets.

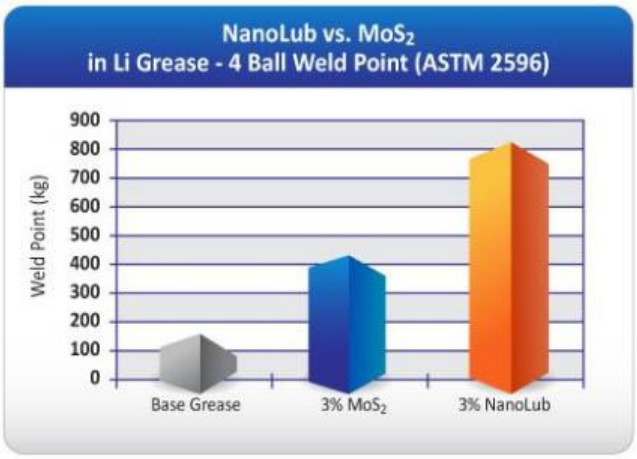
The innovative NanoLub product offering incorporates a succession of unique products designed for a series of applications, including NanoLub RC-X Additive for Engine Oils (formulated to reduce wear and prolong engine life); NanoLub MP-X Additive for Heavy Duty Oils (created to significantly improve anti-friction and anti-wear) and NanoLub GH-X Paste Additive for Greases (designed for extreme pressure performance).

NanoLub is formulated to ensure both low friction and anti-wear properties at extreme pressures

As mentioned previously, the importance of selecting an established partner and supplier cannot be overemphasized. A leader in the field, NanoMaterials was named as a top performer in the Network of Automotive Excellence Innovation Award 2010 competition. This award came on the heels of another prestigious recognition – that of "Nanotechnology Company of the Year 2010", granted by the Israel Ministry of Industry & Trade. The NanoLub product itself was recently cited by Nano Techwire as a product displaying promising performance for space applications, having significantly surpassed aerospace application tests. NanoMaterials' widely recognized industry excellence, coupled with their unique capability to supply for international demands annually, makes the corporation an obvious choice.

Case Studies and Testimonials

As with any product offering or evolving technology, the true test of NanoLub lubricant additives lies within both academic review and consumer response. In a study of **NanoLub** products compiled by the School of Chemical Engineering and Advanced Materials, Newcastle University, the authors concluded, "The results show that a significant increase in the operational life of rolling/sliding components can be achieved by using lubricants incorporating inorganic fullerene-like materials".



In a similar research study conducted by Burak Bullac and Ozgen Akalin (Istanbul Technical University), it was found that "a thin tribofilm gradually forms on the piston ring and the cylinder bore surfaces, reducing the friction coefficient in a mixed lubrication regime."

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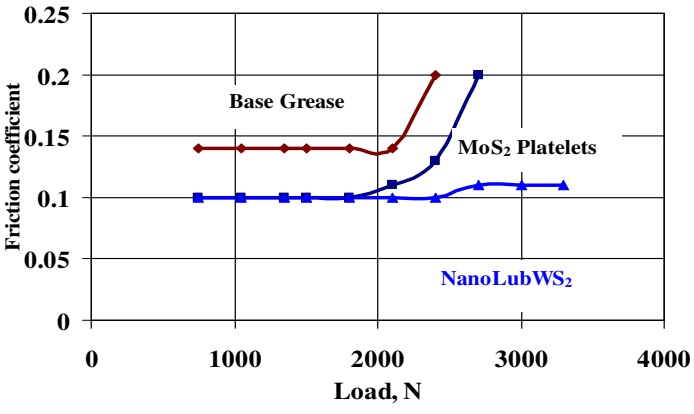
In a testimonial submitted to NanoMaterials manufacturer LUVAL by A.A.C.H. lubrication manager Flavio Román notes that the product "causes a decrease in friction, and therefore savings in energy consumption among other advantages. In our constant search for lubricants that can yield savings in this field, we have focused on finding high technology products that are capable of reducing energy consumption, overcoming the barriers imposed by the antagonistic properties of high load support and low friction…. According to the extension of applications and the good results obtained and the estimated savings, we will proceed to apply these new products in the mines we control."

Lastly, in accordance with a testimonial submitted by Sr. Dennys Contreras, CMPC Maderas Planta Bucalemu, the incorporation of NanoLub reduced 50 "disarmament" events in 2008 down to just four the following year, freeing associates to focus on other critical projects. "Me da tranquilidad," he says [It brings me peace].



NanoLub significantly reduces friction better than conventional solid additives.

Summary

Peace of mind is not all NanoLub can offer its clients, as illustrated above. Designed to ensure both low friction and anti-wear at extreme pressures, NanoLub eliminates the need for two separate additives and thus lowers overall cost. NanoLub reduces noise and friction better than other additives, improves energy efficiency, decreases heat production, and improves power output.

Forecasted potential consumer savings, coupled with an anticipated demand for the product, prompted NanoLub to construct a unique, global manufacturing plant in Israel featuring cutting-edge production technology. With its significant manufacturing capacity, the plant facilitates the means to supply year-round programs for international consumers at a competitive price point, solidifying a dependable partnership with NanoLub clients for both current and future endeavors. A recognized industry pioneer and a trusted supplier with an incomparable solution offering, NanoLub brings NanoMaterials to the forefront of this revolutionary technology.