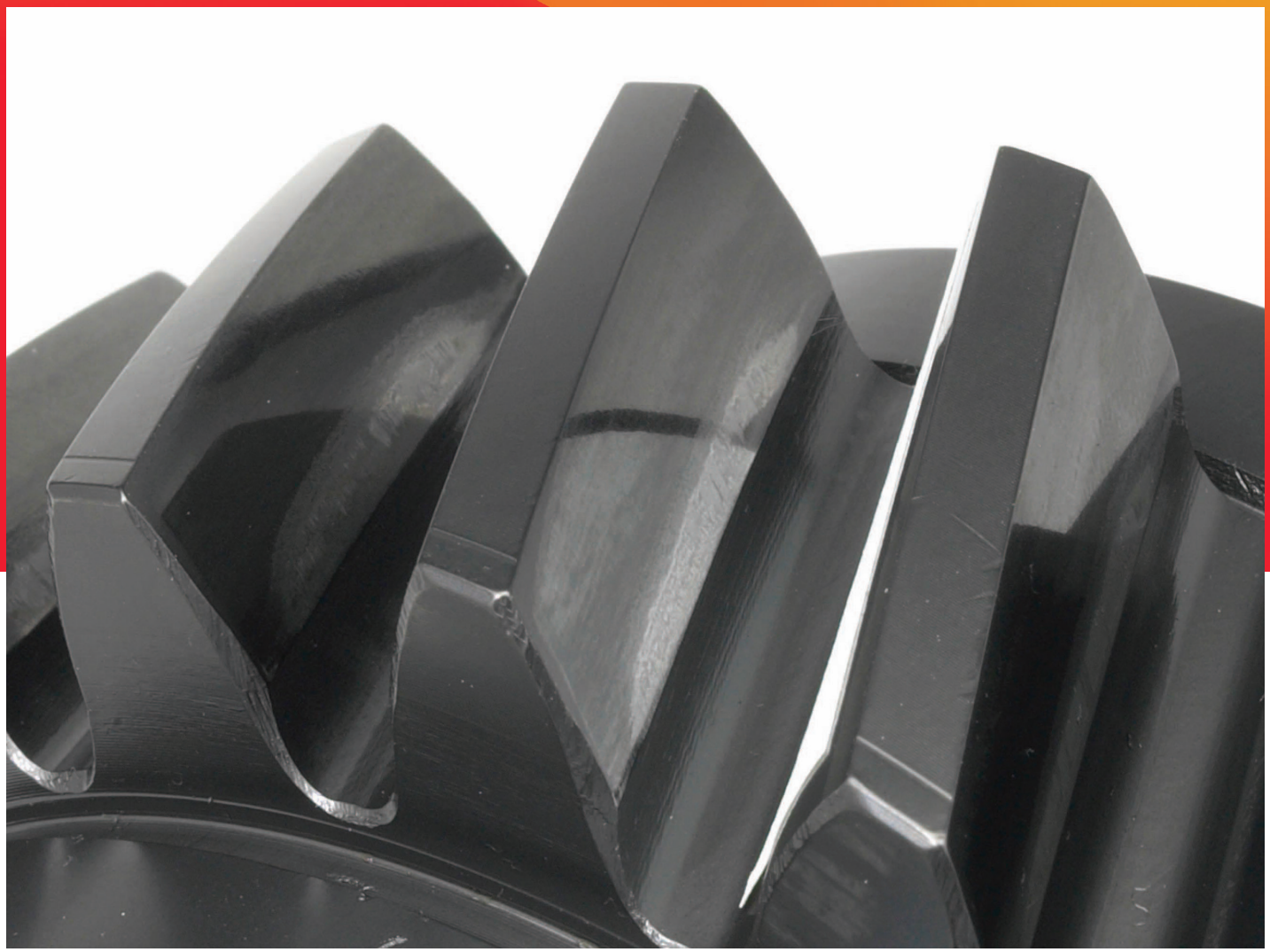
METALLUS



ULTRAPREMIUM™ TECHNOLOGY

IMPROVED FATIGUE LIFE AND POWER DENSITY START WITH CLEAN STEEL.

Metallus' **Ultrapremium™** certified air-melt technology takes cleanness to a higher standard.

Our advanced processing can be applied to most grades of steel and dramatically lowers oxide inclusions over competing processes. The result: optimum performance and longer life at a fraction of the cost of remelted steels.

Oxide inclusions contribute to early failure in engineered components like gears and bearings. By reducing the size and concentration of oxide inclusions in steel, **Ultrapremium** technology allows:

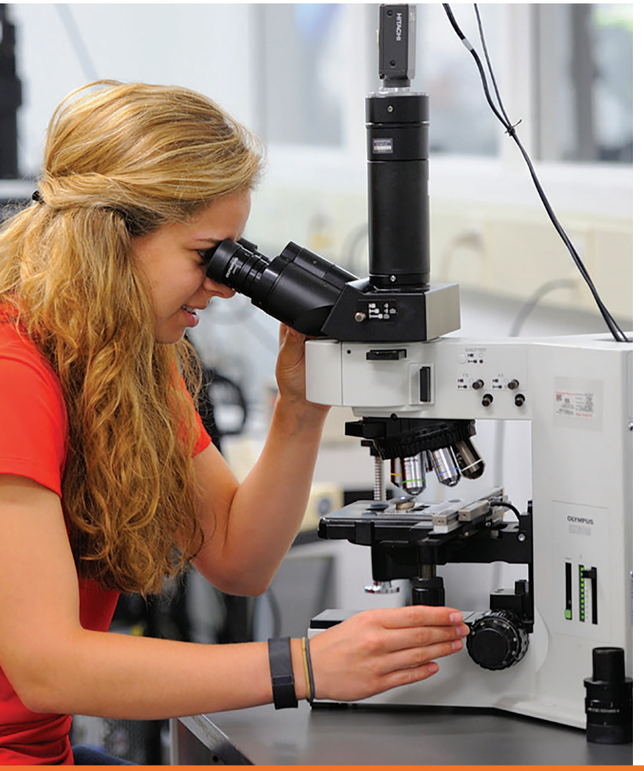
- An increase in power capacity at current size;
- A reduction in size and weight at current power levels and
- Improved durability/fatigue life performance.

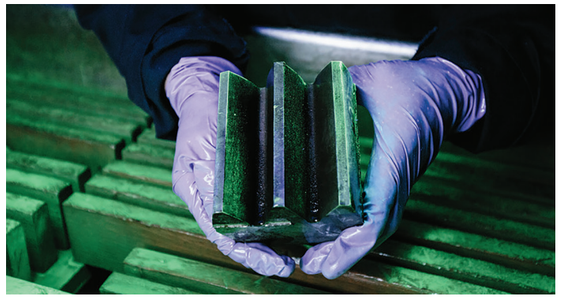
MEASURING UP: ULTRAPREMIUM-CERTIFIED

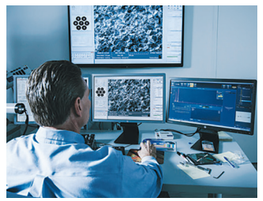
Traditional steel cleanness measurements fail to provide information that directly correlates with application performance. These processes do not measure enough area to accurately provide the statistical detail of whether critically sized inclusions are present in a component. Essentially, these methods may underestimate the likelihood of flaws that can impact fatigue performance.

In comparison, Metallus' **Ultrapremium** practice measures and certifies the results using automated scanning electron microscopy (SEM) with energy-dispersive x-ray spectroscopy (EDS) capability. This allows rapid inspection of a larger area, providing improved understanding of the overall inclusion population. And that means more meaningful cleanness metrics relevant to component design, allowing customers to easily determine the probability of critically sized inclusions. These metrics include:

- Average concentration of oxide inclusions greater than 10 and 20 microns in size;
- Average concentration of oxide stringers greater than 100 and 200 microns in length;
- Maximum likely-sized inclusion.





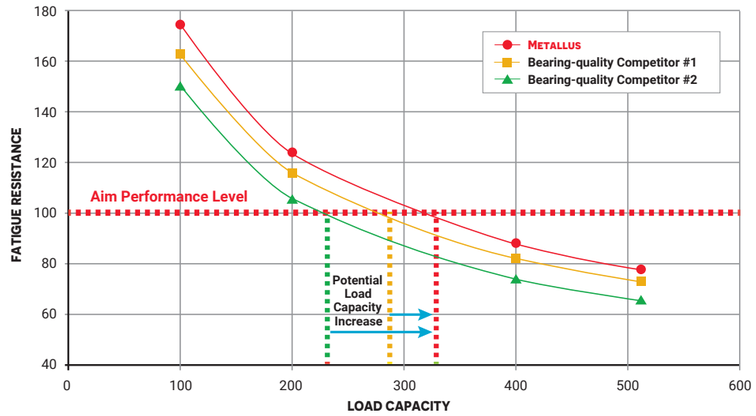


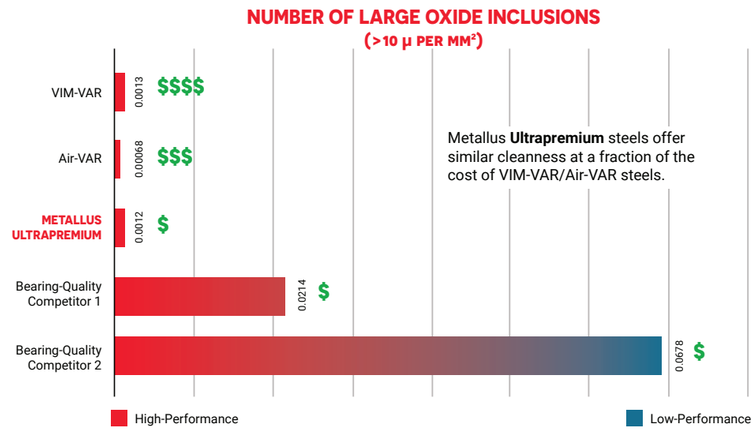
ULTRAPREMIUM TECHNOLOGY

SEE THE PROOF: COMPARING METALLUS' ULTRAPREMIUM STEELS TO OTHER SUPPLIERS

In this engineering analysis, oxides greater than 10 microns may represent critical flaws in applications where principal stresses exceed 1,500 MPa. Metallus **Ultrapremium** steel is compared to samples from two domestic bearing-quality special bar quality (SBQ) steelmakers, as well as two domestic re-melted steels.

The results demonstrate Metallus **Ultrapremium** steels are significantly cleaner than domestic SBQ bearing-quality (AGMA Grade 3) steels, and on par with vacuum arc re-melted (VAR) steels. And the benefits of that are clear: improved power density, longer fatigue life and longer service life over other steel producers.



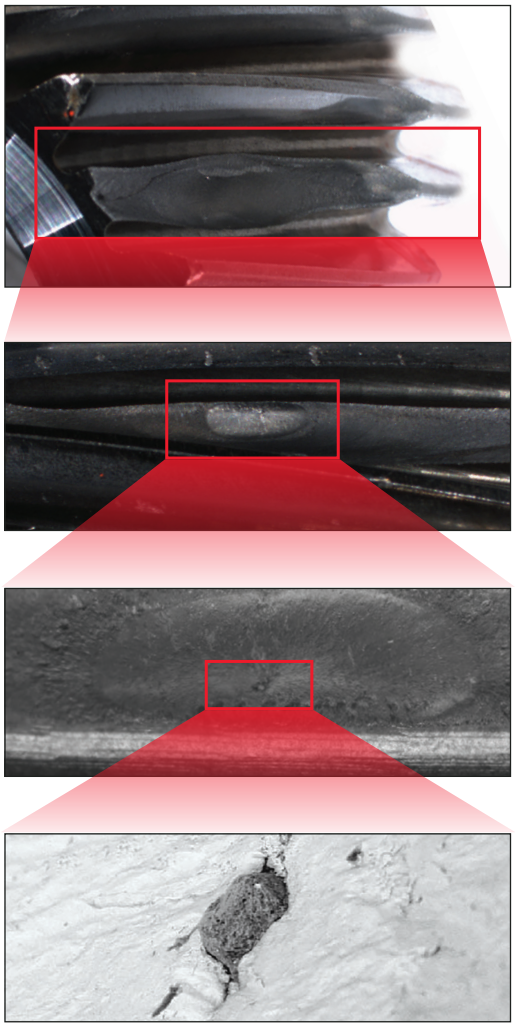


REAL-WORLD PERFORMANCE

The quality of our **Ultrapremium** steels comes to life in customer applications. A customer making sophisticated power generation and transmission systems tested gear sets made from our **Ultrapremium** steel. Those tests simulated exposure to the harshest service environment conditions, running 100 hours in extreme conditions. Historically, these tests resulted in failures with competitor materials. With **Ultrapremium** steel, all 10 gear sets passed with no failures or signs of fatigue.

When performance counts, Metallus **Ultrapremium** technology delivers improved fatigue life and power density.

EXAMPLE OF A GEAR TOOTH FAILURE CAUSED BY AN OXIDE INCLUSION.



TAKING PREMIUM TO THE NEXT LEVEL

Our existing Parapremium™ melt practices resulted in the development of a higher-quality AMS2304 industry standard. Now, our internally developed, proprietary testing allows us to further improve upon the factors that set our clean steels apart. That next level is Metallus **Ultrapremium** technology.

Ultrapremium steels employ our advanced manufacturing processes and are certified to a higher level of material cleanness than ever before. Whatever the application, our **Ultrapremium** processing can be applied to most grades, achieving improved performance without changing steel specifications or manufacturing practices.

Ultrapremium steels, combined with chemistry control and product consistency, contribute to better products by:

- Increasing the amount of load, leading to more power-dense designs;
- Increasing legislative-mandated fuel efficiency and reducing greenhouse gases through the ability to downsize;
- Reducing your total supply chain cost by decreasing manufacturing and processing costs;
- Maintaining critical process variables like distortion control since **Ultrapremium** does not require changes in grade or manufacturing processes; and
- Achieving better fatigue resistance by reducing bending, rolling and sliding fatigue.

Our ability to understand, measure, reduce and control inclusions means the biggest wins in time and money for our customers, no matter the specifications.

TO LEARN MORE about how **Ultrapremium** technology meets your needs, scan the QR code, visit **Metallus.com/ultrapremium** or call **330-471-5746** or **330-471-5652**.

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Visit **METALLUS.COM** or call us at 866.284.6536 (USA), +44 (0) 116 2325186 (Europe), +52 (55) 5876 9888 (Latin America) and +86 (21) 60231080 (China).