NASA TECHNOLOGY TRANSFER

Commercial Applications of Aerospace Technology

MSFC-388 Material Properties Data Sheet MSFC-398 Material Properties Data Sheet

Technology Opportunity

High-Strength and Wear-Resistant Aluminum Alloy

NASA's novel aluminum-silicon alloy offers dramatic strength at high temperatures

Developed to meet U.S. automotive legislation requiring low-exhaust emission, the novel MSFC-398 aluminum-silicon alloy offers dramatic improvement in tensile and fatigue strengths at elevated temperatures, enabling new pistons to utilize less material, which can lead to reducing part weight and cost as well as improving performance. MSFC-398 also offers greater wear resistance, surface hardness, dimensional stability, and lower thermal expansion compared to conventional alloys. The new alloy can be produced economically using conventional gravity casting or die-casting.

A new alloy, developed by NASA, may help U.S. engine manufacturers cost-effectively reduce emissions.

Benefits

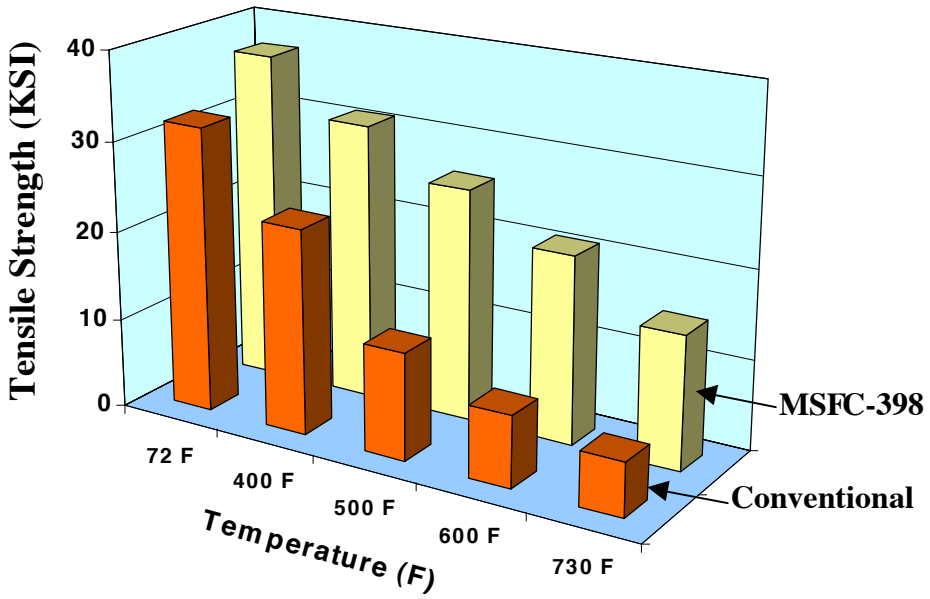
- Significant improvement in tensile strength at elevated temperatures (500 to 700 °F)
- Enables optimized designs that require less material, thus reducing part weight and cost
- Suitable for conventional mass production using permanent molding methods
- High stiffness at elevated temperatures
- Low thermal expansion
- High hardness and wear resistance
- Enables improved gas mileage and reduced emissions in automotive piston applications

Potential Applications

- Automotive engine parts and heavy duty diesel engines
- Aircraft pistons, connecting rods, and gear and generator housings
- Applications requiring high strength and wear resistance at elevated temperatures
- High-strength, lightweight aluminum castings for the aerospace industry
- Internal combustion engine pistons, blocks, manifolds, and cylinder heads
- Outboard motors, snowmobiles, and recreational combustion engine parts

National Aeronautics and Space Administration
Marshall Space Flight Center

Performance Comparison of Alloys



Gasoline and Diesel Applications

MSFC-398 alloy can be utilized in automotive applications with high mechanical loading at elevated temperatures from 500 °F (260 °C) to 700 °F (370 °C). MSFC-398 alloy can offer dramatic strength improvement in as much as 90% compared to conventional alloys such as the aluminum-silicon hypereutectic 390 and eutectic 332. It is anticipated that pistons made from MSFC-398 alloy can offer extended life spans with high wear resistance, high surface harness, and dimensional stability at elevated temperatures. In recent years, increasingly stringent exhaust emission regulations for internal combustion engines have forced piston designers to reduce the crevice volume, between the piston top-land and the cylinder bore, by moving the top piston ring closer to the top of the piston. Such piston design modifications would require a stronger alloy to prevent the piston failure due to higher mechanical and thermal loading of the top ring groove and ring lands. All together, this is one of the key factors that allows todayís high performance gasoline and diesel engines to meet the exhaust emission standards, reducing piston weight, noise and enhancing engine durability.

Commercial Opportunities

This technology is part of NASA's technology transfer program. The program seeks to stimulate development of commercial products from NASA-developed technology. NASA has applied for a patent on this material and is offering companies the opportunity to license the technology to develop new products.

Contact Information

If your company is interested in this technology, or if you would like additional information, please contact:

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