NASA SBIR/STTR Technologies

High Performing, Low Temperature Operating, Long Lifetime, Aerospace Lubricants

PI: Dr. Bryan V. Bergeron / Physical Sciences Inc., Andover, MA

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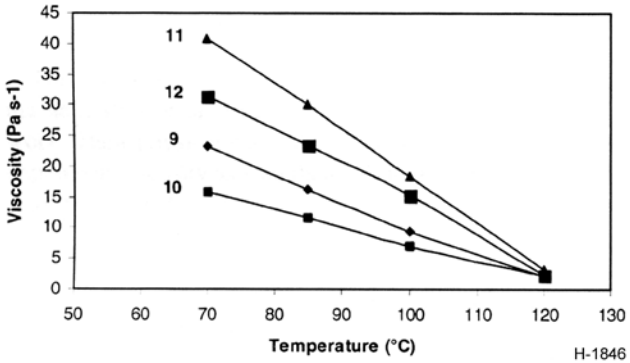
Identification and Significance of Innovation

Future success of aerospace systems and extended space exploration require lubricants that can perform effectively over long lifetimes and require minimal or no maintenance due to limited electrical power and logistical constraints. Aerospace lubricants must not evaporate under vacuum, be chemically stable, function over a wide temperature range, have large heat capacities, possess high viscosity indices (VI), and exhibit low friction coefficients. They must also have corrosion resistance, moisture stability, and environmental compatibility. The proposed ionic liquids (ILs) will address these concerns and demonstrate great promise as aerospace lubricants.

Expected TRL Range at the end of Contract (1-9): **3**



Temperature dependent viscosity of some ionic liquid lubricants

Technical Objectives and Work Plan

The specific objectives are as follows:

- Demonstrate synthesis and high purity of the lubricants
- Measure thermal properties of the ionic liquids; $T_{m/g} < -65^{o}C$
- Demonstrate low viscosities (< 20 cP at 25°C and < 4000 cP at –20°C) and high VI of the lubricants. Obtain temperature dependent viscosities of the lubricants (-20°C to +100°C).
- Demonstrate lower friction coefficients, lower wear effects, and lower corrosion effects of the most promising formulation relative to Pennzane.

We propose a program comprising 4 tasks designed to meet each objectives.

- Task 4.1 – Synthesize and Characterize New Lubricants
- Task 4.2 – Measure Temperature Dependent Viscosities
- Task 4.3 – Obtain Friction Coefficients Under Extreme Pressure Properties, Wear Effects, and Copper Corrosion
- Task 4.4 – Reporting

NASA and Non-NASA Applications

The proposed lubricants and formulations will have direct applications to NASA aerospace systems that require minimal/no maintenance over extended periods of time. These compounds will provide lower volatility, decreased wear effects, and better tribological characteristics than those of standard liquid or grease lubricants that are currently used, particularly at lower temperatures.

The proposed lubricants and formulations have applications in terrestrial machinery. They will substantially increase performance, and reduce maintenance costs and frequencies of industrial transportation and construction systems.

Firm Contacts: Dr. Bryan V. Bergeron; Dr. B. David Green
20 New England Business Center, Andover, MA 01810
Phone: 978-689-0003; Fax: 978-689-3232
E-mail: bergeron@psicorp.com; green@psicorp.com

NON-PROPRIETARY DATA