Advanced materials for transportation applications

Policy Message

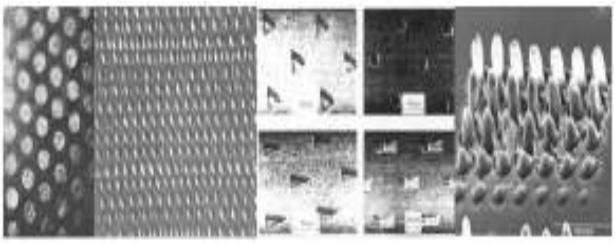
Advanced materials are the building block for modern technologies. We are cooperating on advanced materials testing, standards, and protection to enable the development of energy efficient cars and trucks. The availability of these materials across national boundaries will ensure simultaneous development of fuel efficient cars. We are working on surface texturing to reduce friction, light weight substitution materials, nanomaterials, and nanostructured coatings. Total savings in fuel consumption by these technologies could amount to 5-10%. Key barriers to achieving the goals are the lack of recognition that advanced technology requires a robust materials infrastructure: standards, sophisticated materials testing capabilities, fuel economy standards, tight pollution emission mandates. CAFÉ standards, for example, have played a significant role in improving fuel economy of cars in the US.

Background

The Implement Agreement started in 1984 focusing on advanced diesel engine technology. The advanced material in question at that time was ceramics. Through the efforts of the implementing agreements, test methods, standards, component technology were developed jointly to enable the free flow of this advanced material world-wide to support low heat rejection engine technology development. The IA has five Contracting Parties: US, Belgium, Sweden, Germany, and Canada, other countries such as China, UK, Japan, Finland, Australia are in various stages in joining this IA. Invitations to send observers have been issued to interested parties such as S. Korea, Israel, and Singapore as a preliminary step of participating in this activity. The IA is organized into four annexes: surface technology, ecomaterials including weight reduction material substitution; coatings and thin films; and new emerging materials.

Spotlight

Reduction of parasitic loss in moving parts is an important energy conservation goal. Friction arises from two interacting surfaces sliding over one another under load. The nature of the surface properties (topography, hardness, elasticity, etc.) and the operating conditions control the magnitude of the frictional force. The use of surface modification technology can have significantly impact on fuel efficiency in the transportation technologies, especially in the heavy duty trucks engine area which is evolving rapidly to meet the pending emission standards. Surface textural patterns shown below are being developed and some patterns are able to reduce friction between surfaces by as much as 40%.



Another area is the use of magnesium alloys in vehicles to reduce weight, (see examples above) hence improve fuel efficiency. Corrosion protection is an important aspect for successful low cost insertion into current vehicles.

Current Projects

Surface texture design guidelines for engine components
3-d descriptor of textured surfaces
Standard testing methods for friction measurement
Coatings for Magnesium alloy corrosion protection
Nanomaterials characterization
Advanced coating evaluation techniques