

Enhanced Fuel Combustion with Solvated Metals

Metal-additive fuels solvated in non-carbon solvents (e.g., ammonia) that boost specific impulse and stable combustion for high-performance propulsion.

Researchers at Purdue University have developed a combustion system consisting of solvated metal additives. To satisfy the world's increasing energy demands as well as to reduce the carbon footprint, the quest for energy efficient fuels continues. Purdue researchers developed a fuel with metal additives solvated by outer-sphere electron transferring solvents that do not contain carbon, like ammonia. Compared to other non-carbonaceous fuels like liquid hydrogen, liquid ammonia is easier to store, transport, and handle. Additionally, ammonia is already industrially significant, and methods of manufacturing, handling, and transportation are well-known. This technology theoretically outperforms hydrazine, a non-carbonaceous fuel, at higher oxidizer-to-fuel mass flow ratios as a propellant fuel and can be hypergolic. The fuel is easier to ignite than ammonia and is expected to sustain combustion more stably due to the high reactivity of the metal additive and, thus, could militate against flame-out conditions. The fuel is also less toxic than hydrazine.

Technology Validation: The fuel demonstrated a higher specific impulse than neat liquid ammonia at oxidizer to fuel ratios of 0.5-4.5.

Advantages:

- Easy to store, transport, and handle
- Established methods of manufacturing
- High-performance
- Non-carbonaceous
- Less toxic than hydrazine

Applications:

- Energy-dense fuel for combustion

Technology ID

2022-SON-69803

Category

Aerospace & National
Security/Hypersonics &
Propulsion Systems
Energy & Power
Systems/Hydrogen & Fuel Cell
Systems
Chemicals & Advanced
Materials/Materials Processing &
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- Rocket propulsion

TRL: 2

Intellectual Property:

Provisional-Gov. Funding, 2022-05-31, United States | Utility-Gov. Funding,
2023-05-30, United States