

TECH OFFER

Ultra-Lightweight Materials for Aerospace Applications



KEY INFORMATION

TECHNOLOGY CATEGORY:
Materials - Composites

TECHNOLOGY READINESS LEVEL (TRL): **TRL4**
COUNTRY: **JAPAN**
ID NUMBER: **TO175455**

OVERVIEW

Conventional lightweighting materials often face an inherent trade-off between structural integrity, weight reduction, and multifunctionality. Common composites and polymer foams achieve lower weight but typically compromise on mechanical robustness, acoustic absorption, or electromagnetic compatibility—limitations that constrain energy efficiency, payload optimization, and system reliability in next-generation aerospace and urban air mobility platforms.

This technology introduces a new class of ultra-lightweight functional materials with densities below 10 mg/cm³, offering a combination of extreme lightness, tuneable multifunctionality, and structural stability. By combining extreme lightness with multifunctionality, it addresses critical challenges in industries such as aerospace, urban air mobility, and advanced electronics. Key applications of these materials include noise reduction through sound-absorbing materials for drones, eVTOLs, and aircraft; lightweight electromagnetic shielding and wave absorption for aerospace and communication systems; and thermal management solutions, including insulation materials for aircraft, that enhance energy efficiency and operational safety.

The technology owner is interested to work with aerospace, mobility, or electronics manufacturers on joint R&D projects, prototyping and test-bedding opportunities to commercialise the next-generation of lightweight materials.

TECHNOLOGY FEATURES & SPECIFICATIONS

The ultra lightweight and multifunctional materials exhibit the following features:

- Ultra lightweight sound absorption - significantly lighter than conventional insulation or acoustic foams, enabling weight reduction without compromising performance.
- Broadband electromagnetic shielding - capable of shielding electromagnetic waves across a wide frequency spectrum, suitable for aerospace and advanced communication systems
- GHz-range absorption - has absorption properties in the GHz range, addressing critical needs for drones, eVTOLs, and satellite systems
- Thermal management performance - the materials have thermal insulation and management capabilities, applicable to aircraft cabin insulation and other high-demand environments
- Buoyant functionality - the material is lighter than air that naturally levitates in the atmosphere, unlocking opportunities for novel applications in aerospace, robotics, and energy systems.

POTENTIAL APPLICATIONS

Ultra-lightweight materials can be used in drones, eVTOLs, aircraft, and spacecraft applications to address the following challenges:

- Suppressing electromagnetic noise
- Enhancing communication quality in communication devices
- Noise reduction for drones and eVTOLs
- Thermal and acoustic insulation requirements

UNIQUE VALUE PROPOSITION

- Extremely low density ($<10 \text{ mg/cm}^3$) – provides significant weight savings compared to conventional materials
- Multifunctional - combines sound absorption, EM shielding, and thermal management into a single tunable material
- Lighter-than-air capability - offers a paradigm shift in aerospace materials design, enabling lightweight, high-performance, and energy-efficient components that meet stringent performance demands