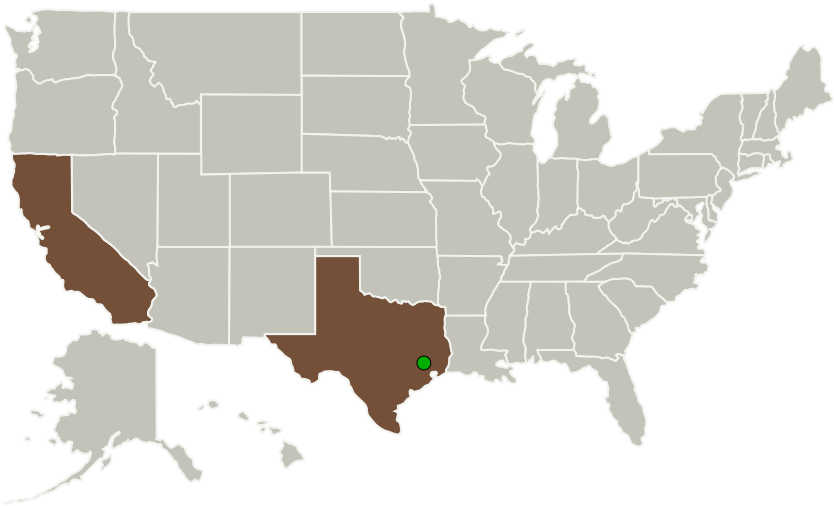
Modified Ionic Liquid-Based Phase Change Materials as Effective Heat Exchangers, Phase II

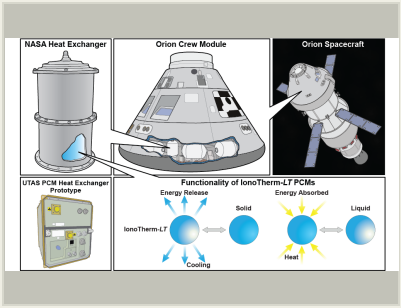
Completed Technology Project (2017 - 2019)

Project Introduction

Future manned mission venturing into deep space will require sophisticated thermal control systems to protect against extreme environments ranging from direct illumination by solar radiation to complete darkness. To manage these extremes, heat exchangers composed of phase change materials that can expand and contract without causing structural damage, will be essential. This project will further-engineer ionic liquid-based phase change materials (PCMs) to: (1) tune the melting point for ORION platform heat exchanger applications, (2) further-elevate thermal conductivity for both solid and liquid, and (3) evenly-regulate heat transfer among components. In Phase I, InnoSense LLC (ISL) developed effective PCM formulations and tested their thermal properties. These materials exhibited high heat of fusion (254-272 kJ/kg) with low volume expansion (4-6%) compared with the current standard, pentadecane (~6-7%). We demonstrated IonoTherm to have higher thermal conductivity, heat storage, thermal diffusivity and thermal inertia over pentadecane. Further, tests indicated that IonoTherm did not corrode metallic substrates, phase-separate or degrade. In Phase II, ISL will fine-tune the PCM formulation and evaluate it in a flight level prototype heat exchanger. A NASA prime contractor has teamed with ISL to transition ISL's IonoTherm, and perform independent testing during Phase II and beyond under simulated field conditions.

Primary U.S. Work Locations and Key Partners





Modified Ionic Liquid-Based Phase Change Materials as Effective Heat Exchangers, Phase II Briefing Chart Image

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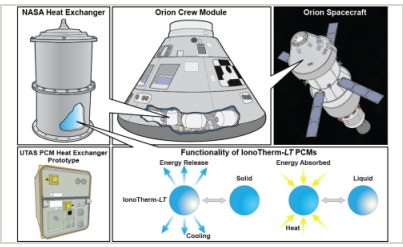
Completed Technology Project (2017 - 2019)

Organizations Performing Work	Role	Type	Location
Innosense, LLC	Lead Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB), Women-Owned Small Business (WOSB)	Torrance, California
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
California	Texas

Images



Briefing Chart Image
Modified Ionic Liquid-Based Phase Change Materials as Effective Heat Exchangers, Phase II Briefing Chart Image *(https://techport.nasa.gov/image/127681)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Innosense, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

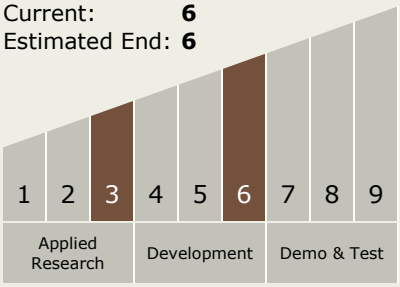
Carlos Torrez

Principal Investigator:

Kevin Yu

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX14 Thermal Management Systems
  └ TX14.2 Thermal Control Components and Systems
    └ TX14.2.3 Heat Rejection and Storage

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System