

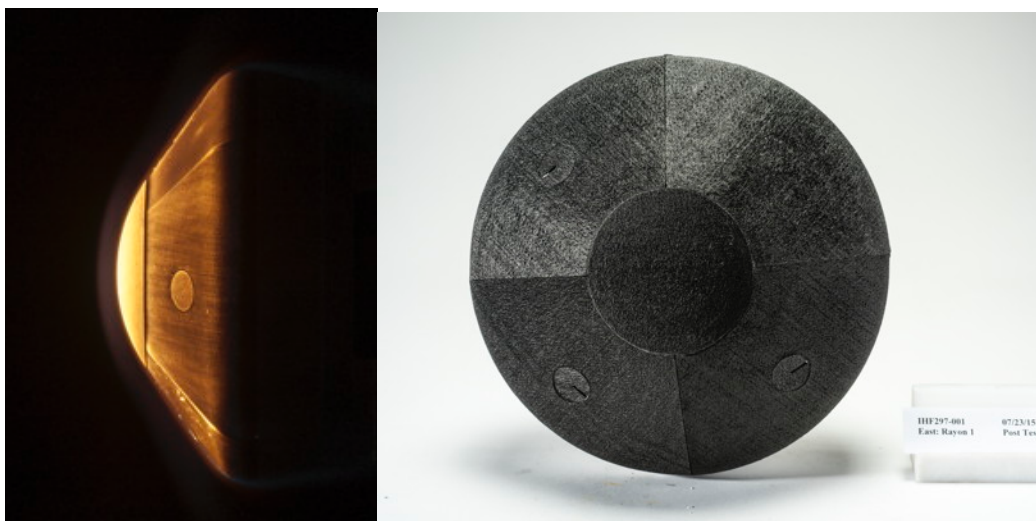
Conformal PICA TPS – Enabling Future NASA Planetary Science Missions

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Initial development of conformal PICA (C-PICA) ablative TPS occurred under NASA's Hypersonics Project in the 2000's and demonstrated very low through the thickness conductivity compared to state-of-the-art PICA. PICA, which was first demonstrated on Stardust, has some inherent limitations that C-PICA improves on, primarily strain to failure. More recently C-PICA has been further matured and a family of C-PICA materials are now ready for consideration as an enabling technology for New Frontiers and other NASA missions. C-PICA has several improvements compared to PICA including:

- Higher strain to failure and lower thermal conductivity (up to 55% less than PICA depending on C-PICA variant)
- CTE comparable to typical composite carrier structures
- Temperature independent mechanical properties
- Suited for single piece (up to ~ 1.5m) or tiled configurations
- Larger tiles leading to reduced integration complexity compared to tiled PICA
- Reduced mass compared to PICA due to reduced thermal conductivity

C-PICA has been tested at heating fluxes ranging from 250-1850 W/cm² with excellent performance.



C-PICA model during/post arc jet testing

Based on our evaluation, multiple missions listed on the SMD Technology Showcase will potentially need a thermal protection system capable of withstanding entry environments where C-PICA is suited either as a forebody or backshell TPS. We will be highlighting mature conformal PICA variants to support the following missions at the showcase in January 2023.

Outer Planets		
	Mission Abstract	Comment/Application
1	New Frontiers Titan Orbiter	Aerocapture requires a mass efficient TPS suite - Conformal PICA is very suitable
2	Small Next-Generation Atmospheric Probe (SNAP) For Ice Giant Missions	Conformal PICA for backshell TPS
3	Uranus Orbiter and Probe (UOP)	Conformal PICA for backshell TPS
4	Saturn Probe	Conformal PICA for backshell TPS
Venus		
	Mission Abstract	Comment/Application
5	SAEVe: Seismic and Atmospheric Exploration of Venus	Conformal PICA for backshell TPS
6	V-BOSS: Venus Bridge Orbiter and Surface System	Conformal PICA for backshell TPS
7	Venus In Situ Explorer (VISE)	Conformal PICA for backshell TPS
8	Cupid's Boomerang	Conformal PICA for backshell TPS
Small Body Sample Return		
	Mission Abstract	Comment/Application
9	Ceres Sample Return	Conformal PICA is an alternate to PICA forebody TPS with improved mass efficiency
10	Comet surface sample return (CSSR)	Conformal PICA is an alternate to PICA forebody TPS with improved mass efficiency