

# New Materials for Space Exploration

*Erica Corral is developing new ceramics and composites to protect hypersonic vehicles from the harshness of space.*

Erica L. Corral, assistant professor in the department of materials science and engineering, is being funded by NSF and AFOSR to research new materials for spacecraft coatings that can withstand the harsh environments encountered in space missions.

Corral uses spark plasma sintering to process new ultra-high-temperature ceramic (UHTC) composites. Understanding these ceramics and how they oxidize will pave the way to developing new materials for use in space exploration. Corral said there is the potential for longer missions in more extreme environments if UHTC's are used instead of ablative coatings. "However, the response of UHTCs under hypersonic flight conditions is not well understood," Corral said.

Corral's research focuses on enabling dynamic oxidation behavior in reverse infiltrated UHTC-coated carbon-carbon composites for use as thermal protection material systems in hypersonic vehicles.

The ceramic coatings used in these thermal protection systems include carbides and diborides of silicon, tantalum, zirconium and hafnium. Her previous research already indicates that no single coating offers enough protection, so Corral is investigating the oxidation of multilayer and composite ceramic coating.

Corral uses thermal analysis equipment and a thermal test facility that can duplicate hypersonic flight heat-flux environments, which enable her to study the oxidation kinetics and thermal shock of her coatings.



**Assistant Professor Erica Corral**