Ablative material fracture with peridynamics

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ABSTRACT

Ablative materials enable thermal protection systems (TPS) that favorably lose mass during entry. NASA missions use ablative materials for re-entry to Earth from the Moon (*e.g.* Avcoat for the Artemis mission) and entry to other planet atmospheres (*e.g.* PICA for the Dragonfly mission to Titan). However larger-scale mass loss due to fracture is unfavorable and poses a risk to missions. Resolving fracture due to thermo-chemical-mechanical phenomena in simulations can support experimental testing and certification of materials, by providing understanding of phenomena and extending to flight conditions.

We present peridynamics simulations of ablative materials coupled to material response undergoing mechanical and thermal testing. The fracture behavior is compared to experimental results, and fracture shapes are characterized. We discuss how simulations of TPS fracture inform heat shield design.