



**DST Shells™ are precisely manufactured hollow shells for severe and demanding applications. DST Shells™ are used alone or incorporated into composite materials for other applications**

**CERAMIC**

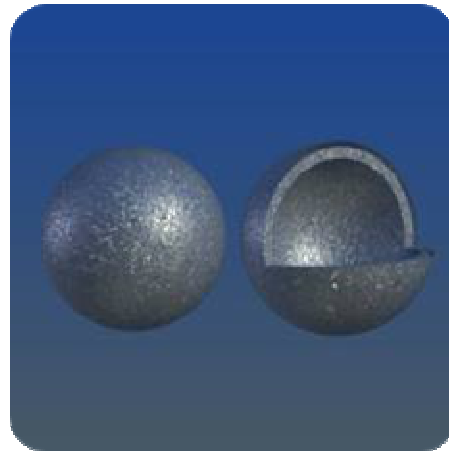
- Silicon Carbide
- Alumina
- Boron Carbide
- Yttrium Oxide
- Zirconium Oxide
- Mullite

**METAL**

- Stainless Steel
- Low Alloy Steel (4140)
- Maraging Steel

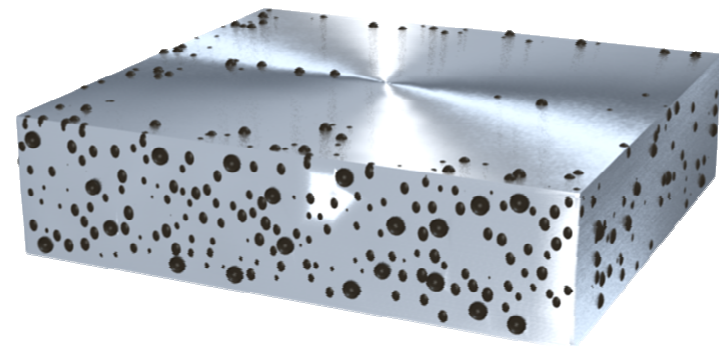
**GLASS**

- Aluminosilicate
- Borosilicate
- Soda-lime



**Single  
DST Shell™**

**DST Shells™  
Incorporated into a composite**



**Matrix**

- Polymer
- Steel
- Aluminum
- Magnesium

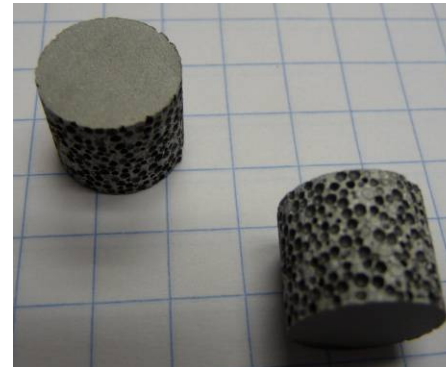
## DST – Lightweight Syntactic Armor Material LSAM ©



The photograph on the left illustrates DST hollow SiC shells with wall thickness suitable for use in aluminum pressure casting. Panels incorporating DST LSAM layers are being tested against blast and ballistic threats.



- Matrix: Aluminum A356 - 2.7 g/cc
- Fill: SiC Ø 3 mm Hollow Shell
- 0.46 g/cc Bulk density
- 0.78 g/cc ~ True density
- Composite: 1.62 g/cc (measured)



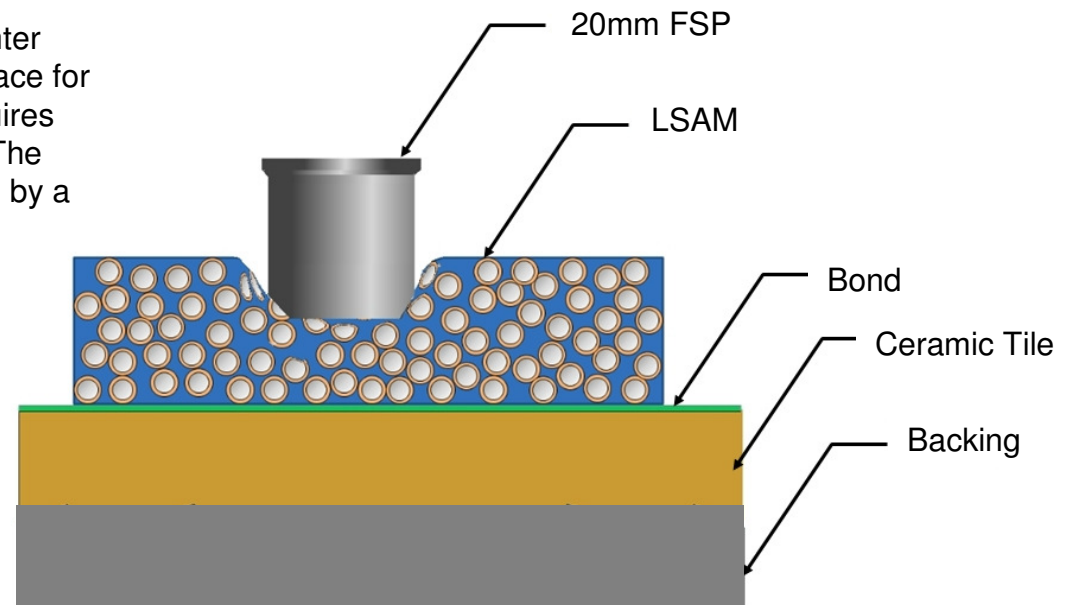
- Matrix: Aluminum A356 - 2.7 g/cc
- Fill: SiC Ø 1 mm Hollow Shell
- 0.70 g/cc Bulk density
- 1.17 g/cc ~ True density
- Composite: 1.84 g/cc (measured)

# LSAM

## Application: Strike Face

*DST's LSAM material is being studied by tier 1 defense contractors for use in lightweight ground and air vehicle protection systems*

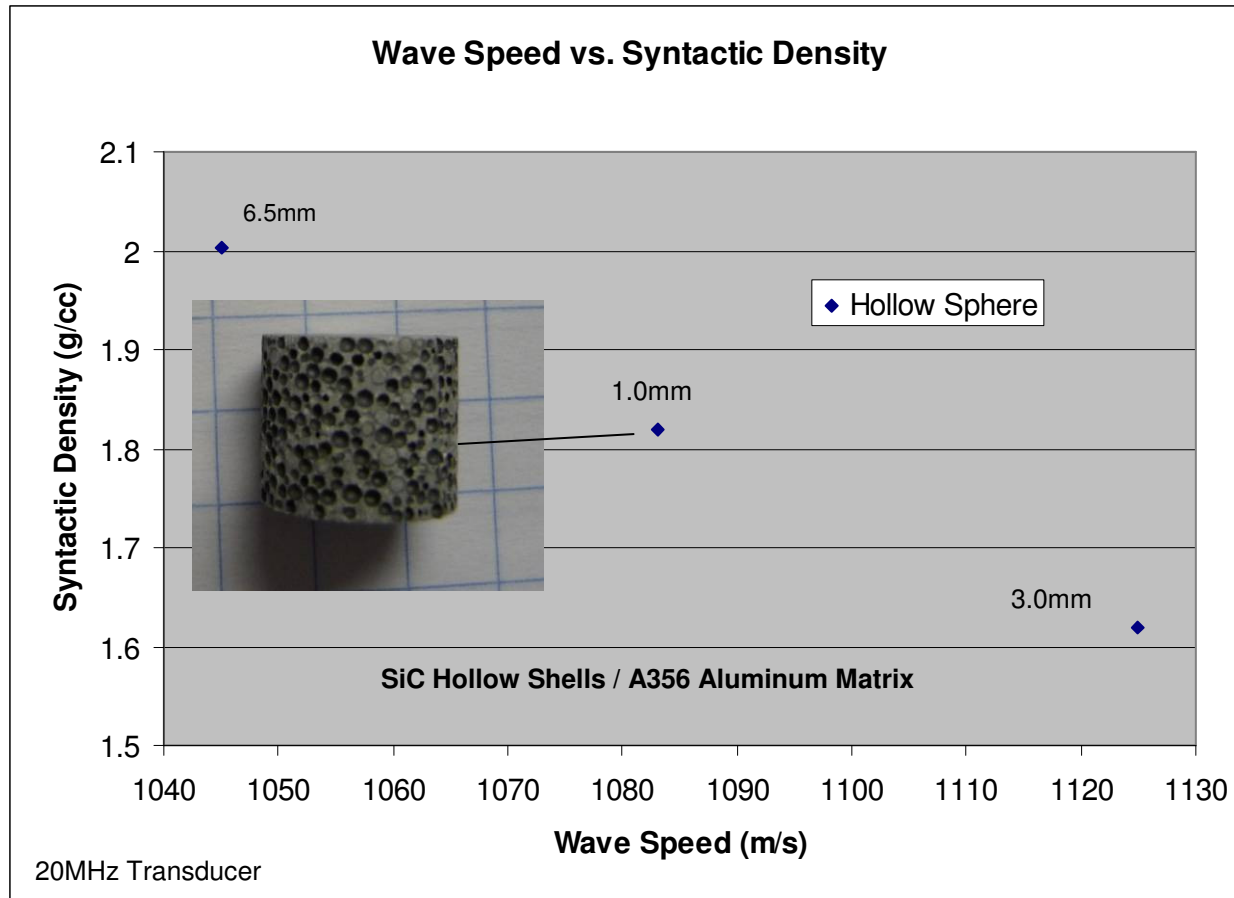
The DST LSAM panel has the ability to be a lighter alternative than the aluminum plate as a strike face for vehicle armor. Functioning as a strike face requires the panel to have good compressive strength. The figure shows the syntactic panel being impacted by a 20mm Fragment Simulating Projectile (FSP).



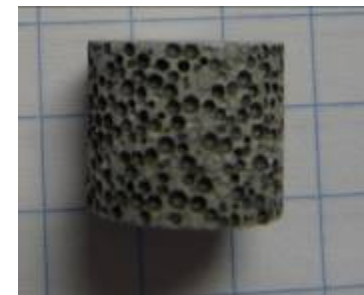
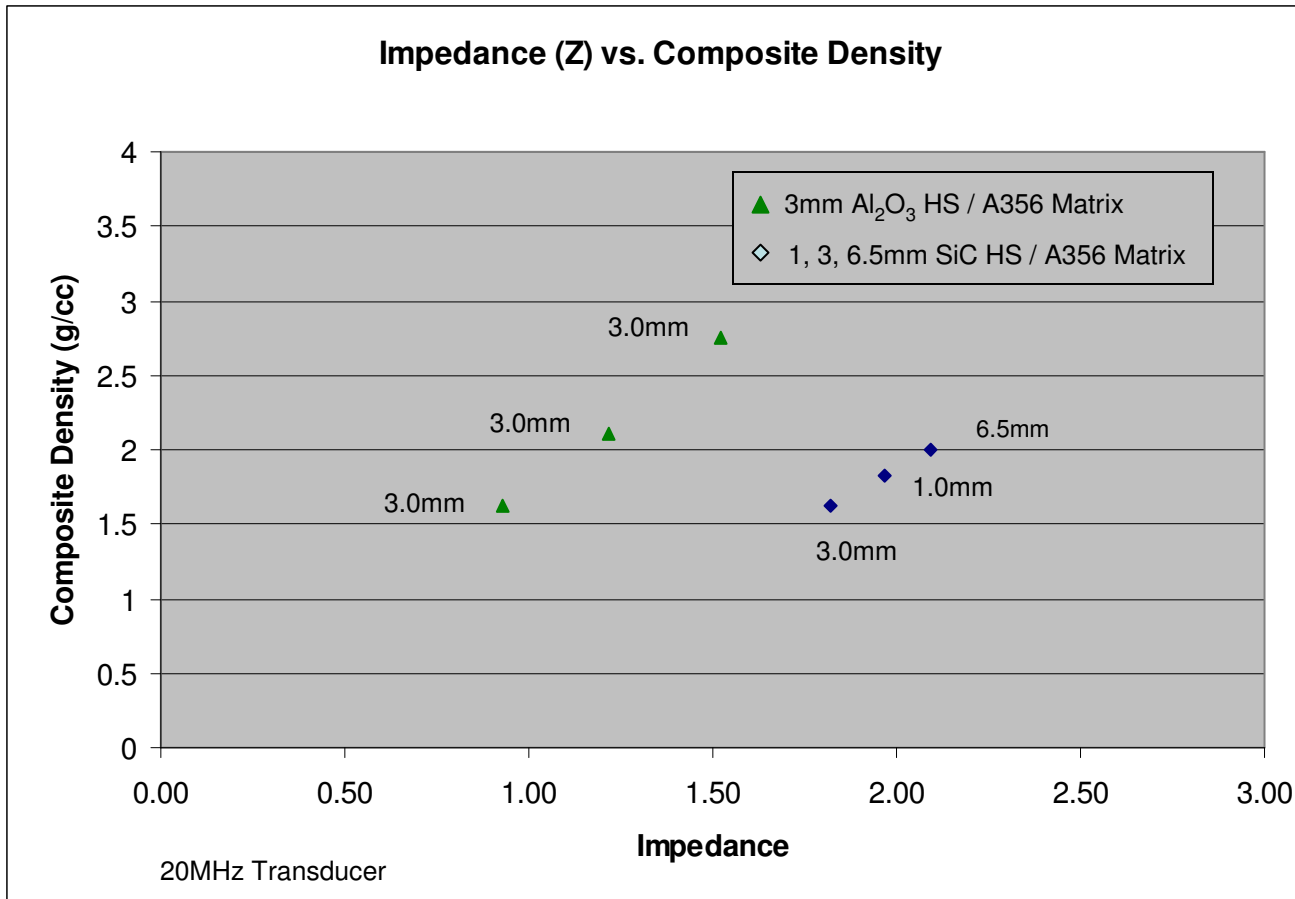
### **Weight Savings for Using a Syntactic Panel Strike Face**

The weight savings of replacing an 8mm 7075-T6 aluminum strike face would be 2.1 PSF.

## Acoustic Testing of A356/SiCHP Syntactic Foam



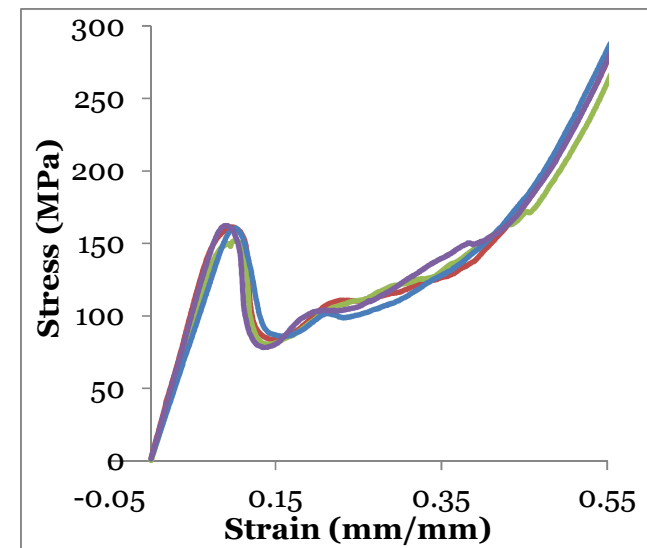
## LSAM - Impedance vs Syntactic Density



**SiC Hollow Shells  
A356 Aluminum Matrix**

### Quasi-static compressive stress-strain graphs of A356/SiCHP syntactic foam

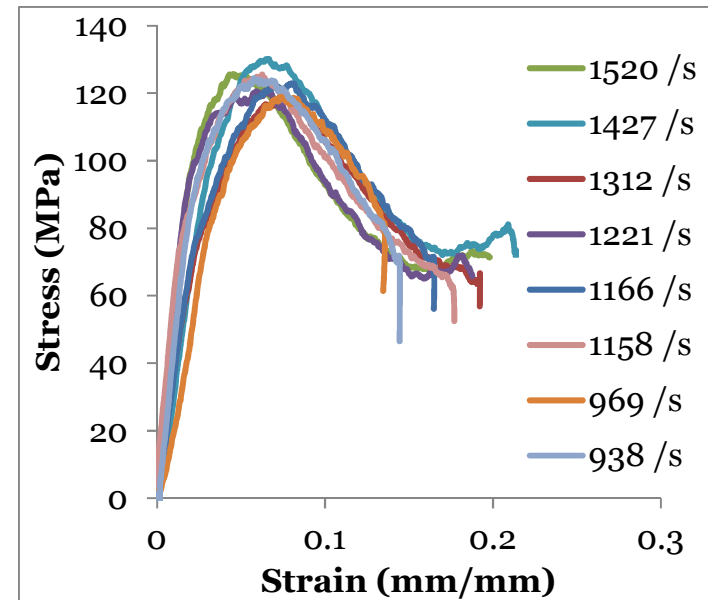
Sample No.	Modulus (GPa)	Compressive Strength (MPa)	Plateau Stress (MPa)	Densification Strain (mm/mm)
1	2.08	161	107	0.46
2	1.85	152	111	0.48
3	1.71	161	102	0.42
4	2.02	162	105	0.48
5	2.10	181	126	0.45
AVG	1.95	163	110	0.46
St. Dev.	0.17	11	9	0.03



**Composite Density 1.81 g/cc**

**A356/SiCHP syntactic foam  
High strain rate properties measured from SHPB testing**

Sample No.	Strain Rate (/s)	Compressive Strength (MPa)	Modulus (GPa)
1	940	124.5	4.7
2	970	119.0	3.0
3	1160	125.5	5.2
4	1165	123.0	3.6
5	1220	120.7	5.7
6	1310	119.3	3.0
7	1425	130.1	3.5
8	1520	125.7	5.8



**Composite Density 1.81 g/cc**