Hex-D/T Honeycomb Superstructure *U.S. Patent 7,208,063*

Honeycomb Structures

For years, the aerospace and defense industries have utilized honeycomb products for their low weight and high-strength properties. In recent years, engineers involved in the automotive, marine and construction fields have shown interest in using honeycomb sandwich-structures as well.

A number of metallic and non-metallic materials are used to produce these honeycomb structures. Since most metallic honeycomb structures are made of aluminum, they are prone to corrosive damage caused by trapped moisture. The materials used to make non-metallic honeycomb structures include fiberglass, graphite, thermoplastics, Nomex (a non-flammable, aramid fiber paper), Kevlar (an aramid fiber) and several other specialty materials. These non-metallic resources can be very high in cost and may not meet the engineering specifications required by the particular application.

ARDL's Hex-D/T Honeycomb Superstructure

ARDL's Hex-D/T structural reinforcement design enables the properties of a celled, honeycomb structure to be enhanced. This is made possible by an inner and outer, double-walled cell that behaves in a way such that the inner cell reinforces the outer cell and vice versa. These cells are located on a base honeycomb sandwich panel in a hexagonal manner, structurally maximizing the design. (U.S. Patent 7,208,063)

The technology has broad potential for future aircraft applications. The Air Force is considering supersonic vehicles that have unique structural requirements. Aerodynamic performance constraints drive the design of these vehicles toward longer, sleeker configurations with thin fuselages, wings and tails (i.e. Concord and SR-71). The design of future high-speed aircraft will continue to be driven by the desire to significantly reduce the structural weight of the aircraft while maintaining or increasing structural strength and stiffness.

ARDL's Hex-D/T honeycomb superstructure technology exhibits double the structural stiffness of conventional cores at the same core weight. This allows for thinner, lower weight, structural designs.

Unstabilized Core, Normalized Data Comparison

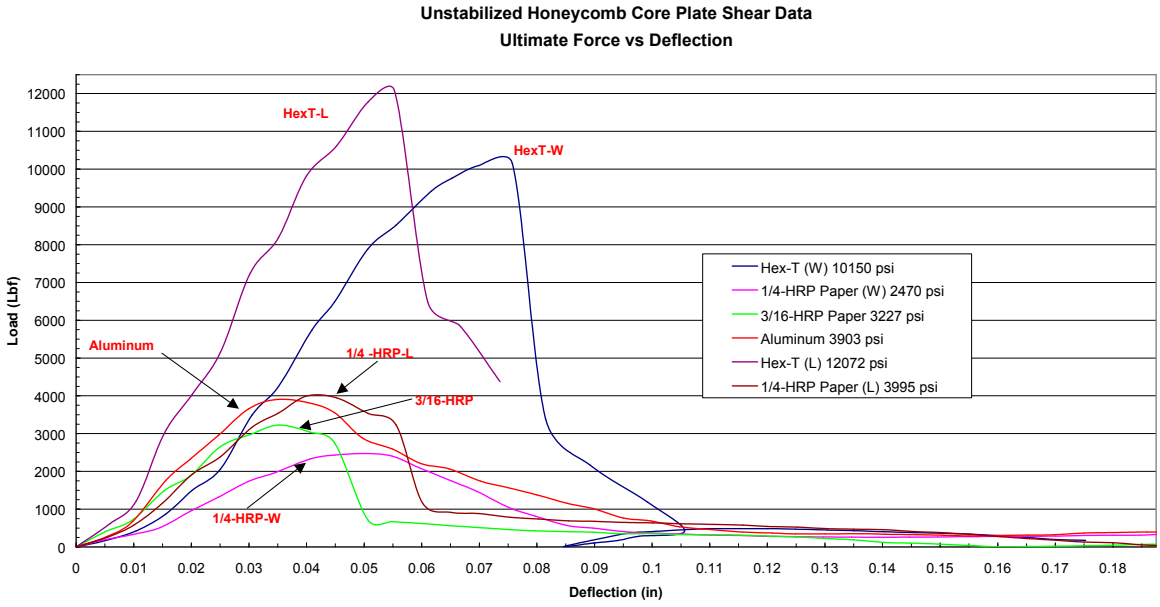
Property	Hex-T (ARDL, Inc.)	HRP	% Change
Density (Pcf)	12.7	4.5	282% Increase
Bare Compressive Strength (psi)	289.0	113.0	256% Increase
Plate Shear (psi)	80.0	74.0	108% Increase
Impact (psi)	158.0	117.0	135% Increase

Hex-D/T Honeycomb Superstructure *U.S. Patent 7,208,063* (cont.)

ARDL's Hex-D/T Honeycomb Superstructure Also Exhibits the Following Advantages:

- Ability to Reinforce in Response to Stress Peaks (Flexibility in Design)
- Ballistic Resistant
- Corrosion Resistant
- Costs Less to Make than Specialty-Material Based Honeycomb Structures
- Enhances Properties of Celled Structure (Impact, Shear, Compression, etc.)
- High Energy Absorbing Capacity
- High Modulus
- High Stiffness
- Low Weight
- Machining / Forming
- Manufacturability
- Moisture Resistant
- Multi-Solution Product
- PCF Flexibility (Optimum Placement of Tubes)
- Shock Mitigation Properties
- Stronger Core-Skin Bond Due to Larger Surface in Contact with Facing
- Suitable for Various Engineering Requirements
- Superior Resistance to Impact Damage
- Support Against Damage Propagation by Containment of Damage within Superstructure

These characteristics are the foundation for this honeycomb superstructure that has better performance and added durability. This double-walled, repeated structure can be manufactured using a forming technique or a corrugated joining process where the final shape of the inner and outer cells can be an ellipse/circle/polygon. It is the way the double-walled cells are organized within the hexagonal superstructure that causes ARDL's Hex-D/T honeycomb core to exhibit such unique properties.



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