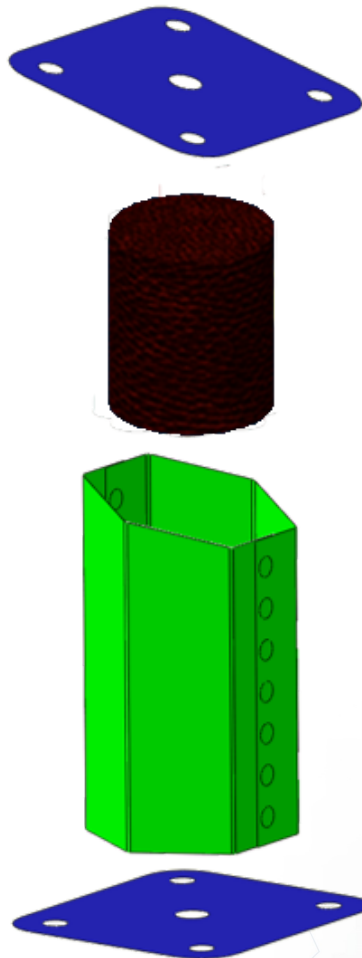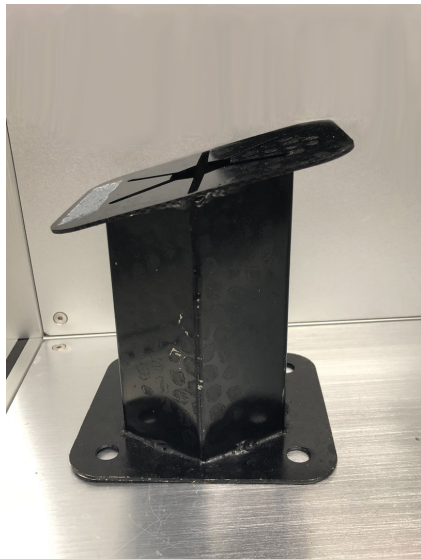# A Crash Box with High Energy-Absorption Capacity Induced by Material Enhancement

Manufacturing

Nanotechnology and New Materials

Smart Mobility and Electric Vehicle

IP Status
Patent granted

Technology Readiness Level (TRL) ❓ 6

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Opportunity

The potential market for the invention is the mid- level and high-level mass-produced passenger car market. Since crash box acts as an important component of passive safety systems on vehicles, new technologies for further improvement of the property of the crash box have drawn more and more attention. Besides, light-weighted design to reduce greenhouse gas emissions has gained worldwide acceptance and becomes the future trend of automotive development. Therefore, it is believed that the automotive manufacturers will be interested in this invention.

In 2015, nearly 70 million passenger cars are produced around the world and the production are still keeping growing every year. If the price of each crash box is set to be USD$50 and one car totally needs 4 crash boxes (2 in the

front and 2 in the rear), the whole market size each year would reach USD$14 billion. If the material of this invention is extended to be used to replace that of other components on cars, such as bumper, B-pillar, roof, etc., the whole market size will be tremendous.

Technology

Crash box is one of the most important automotive parts for crash energy absorption in case of low -speed frontal crash accident. When low-speed crash happens, crash box would start collapsing, prior to other structural components, to convert the impact energy into deformation work to prevent or minimize the damage of the main frame, in particular the chassis , of the automotive. The ability of a low average load at the early stage of collapse and gradually higher average load as collapse continues protects the passengers from the injury by excessive deceleration.

This patent provides a novel crash box with low weight and excellent energy-absorption performance. It is a crash box with a transverse cross-sectional shape of a polygon which is designed to absorb impact energy by repeated buckling of the body in the lengthwise direction, which is induced by material strength enhancement of the crash box body and structure optimization , when impact load is exerted and eventually is compacted into a shape of bellow. Most of the impact energy is intended to be converted to elastic and plastic strain energies by the body deformation during buckling. Also, this crash box can be made by high-strength metal plate to further reduce the weight.

Advantages

- Higher energy-absorption capability

- Lower weight

- Lower initial peak force

Applications

- Automotive Industry

- Subfloor of helicopters

- The highway guardrails