

Self healing structural components



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Self healing structure = self healing material + self healing shape

Introduction

Self healing materials are an important class of structural materials. Self healing means essentially: a material capable of autonomously repairing internal damage, like cracks and pores.

However, on severe impact of structural components, damage is not limited to the occurrence of cracks that should be repaired.

The structure as a whole is often elastically and/or plastically deformed: the structure has lost its original shape.

For a self healing structure it is eminent that both the internal material damage can be repaired and its original shape can be restored.

Approach

A car's body work and central computer system mimic the skin and brain of a human body.

Upon a small scale accident, notified by the car's accelerator sensors, the car checks its vital functions, amongst others: the body work.

If damage is detected via the strain sensor layer on the inside of the body work, the car starts a repairing action.

Distributed heating elements sufficiently heat up the panel to invoke its shape memory material to flip back to the original shape.

The heat can also be used to impose self-healing in the colour coating on top of the body work.

Materials

Shape memory materials (metals and polymers) can be used in the car's body work in the form of:

1. Deep drawn glued/welded shape memory metal panels,
2. Composite material with thermoplastic matrix and moulded-in shape memory wires,
3. Pure shape memory polymer parts.

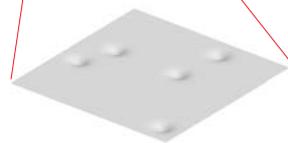
Example: Self repairing of hail damage



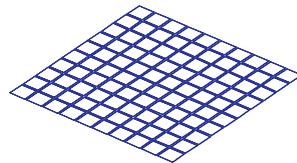
Severe thunderstorm with hail.



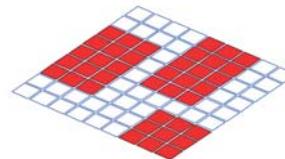
Body panel with hail damage.



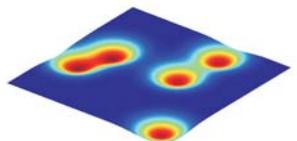
Schematic body panel with hail damage.



Strain sensor layer connected to car's central computer system detects location and extent of damage upon impact.



Heating layer heats up the damaged locations with feedback from strain sensor layer.



Temperature distribution in body panel. All deformed material is sufficiently heated up and...



...the shape memory material flips back to its original shape: a body panel without hail damage.