REVISION CARDS - SELF-HEALING MATERIALS

WHAT IS A SELF-HEALING MATERIAL?

A smart material that is designed to be self-healing. They have been developed to repair damage to their micro structure. This is why some of these materials are called 'smart structures'.

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Self-healing materials reduce the number of diagnostic checks by a skilled technician or computer controlled sensors. Their self-healing capability, extends useful / working product life time.

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Although self-healing of materials have some advantages, the resulting repair may reduce the materials ability to conduct electricity, heat, flex and even impair the materials acoustic properties, such as the ability to insulate sound.

USEFUL LINKS:
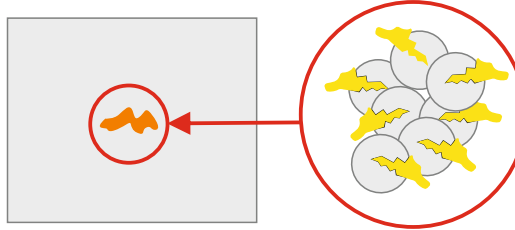http://www.technologystudent.com/despro_3/selfheal1.html
http://www.technologystudent.com/despro_3/selfheal2.html

SELF-HEALING POLYMERS

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Self-healing polymer coating can be applied to metals, as a spray. In the event of corrosion occurring on the surface, corrosion inhibitors are released from micro capsules in the area effected. This can occur at a nano level.

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When an area of the surface begins to display signs of corrosion, the healing process is triggered and the polymer coating releases corrosion inhibitors, from its micro-capsules.

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SELF-HEALING CONCRETE

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Self-healing concrete is a material that heals itself, if cracks or minor damage occurs.
How it works: When the concrete 'cracks', water enters the crack and reacts with a bacteria, which is found in the limestone, one of the constituent parts of concrete. The reaction results in the formation of more limestone, which repairs the crack.

Crack forms - damage.

Water initiates healing process.

The crack is healed, with the new limestone.


1. What is a Self-Healing material ?   *3 marks*

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2. How does a Self-Healing polymer OR Self-Healing concrete work?   *3 marks*

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REVISION CARDS - SMART MATERIALS

QUANTUM TUNNELLING COMPOSITE (QTC)

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A composite material, composed of a insulating material (a polymer) and conducting material. Particles of the conducting material, are suspended within the insulator. In normal use, the composite will not conduct electricity. However, when pressure applied, the conducting particles are pressed together, allowing electricity to flow through them.
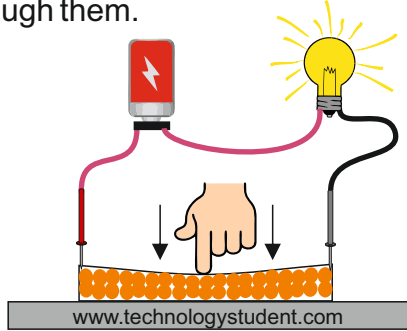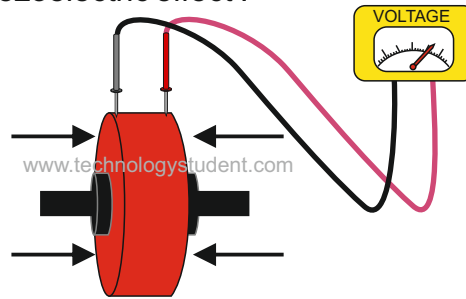

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PIEZOELECTRIC MATERIAL

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When pressure or mechanical stress is applied to a Piezoelectric material, it produces an electrical charge. Piezoelectrical materials include naturally formed crystals (quartz), synthetic crystals, piezo electric polymers, bone, ceramics and some proteins. If an electric charge is put through a piezoelectric material, it will change shape slightly, called 'converse piezoelectric effect'.

VOLTAGE

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PIEZOELECTRIC MATERIAL

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A piezo speaker, a common component in electronic circuits, is seen below. The piezoelectric material expands when it conducts an electric signal and then returns to its normal size, when the signal is absent. This has the effect of vibrating the air in front of it, creating the sound we hear.

AS SIGNAL IS ON AND OFF
PIEZO MATERIAL FLEXES
CREATING SOUND

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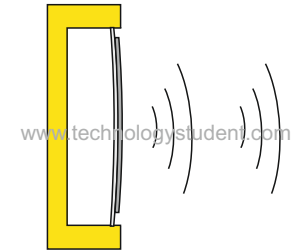
3. What is a QTC and how does it work ?   *4 marks*

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4. What is a Piezoelectric material? Give one practical example.   *4 marks*

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