

Smart Structures and Graphene

Nanaelectronics and Nanocomposites in Bridges

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Introduction

A Smart Structure is one that can conform to the changing environment. This is beneficial because it requires less maintenance and repairs to be made. Smart Structures use sensors, computer chips, and electricity to know when and how to adapt to changes in the environment. Thus, a Smart Bridge will be able to withstand earthquakes, temperatures fluctuations, and corrosion. Furthermore, Smart Bridges will be able to alert the correct people when a structure in the bridge needs inspection or begins failing.

Background Info on Graphene

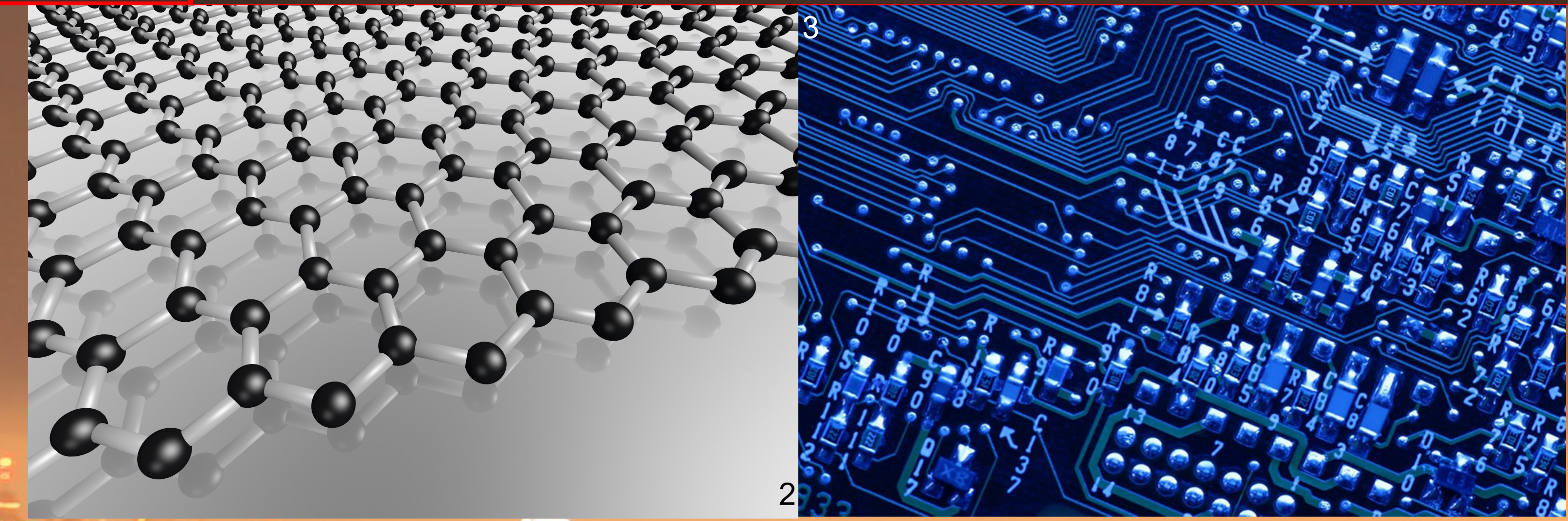
Graphene is a material composed of the element carbon. Graphene is two-dimensional in space that appears like a hexagonal honeycomb. Graphene is basically one layer of the mineral graphite. Graphene has surfaced recently as a material that has many beneficial properties. Graphene is a great electronic transport substance. Graphene is light and incredibly strong for its thinness. Graphene is being heavily researched around the world. The material has outstanding potential for the benefits it could bring to science.^{2, 4, 5, 8}

Graphene Chips

Graphene demonstrates great conductivity properties. The material is able to conduct electrons faster than any other substance. This gives graphene the potential to make ultra-fast computer chips. These ultra-fast computer chips will help the Smart Bridge be able to adapt much quicker and efficiently. The sensors on the bridge will be able to know what changes to make much quicker. This is beneficial when adapting to natural disasters which can strike at any time.^{1, 8}

Other Applications

Graphene chips and supercapacitors will be useful when dealing with BIG DATA. Super ultra-computers will be able to handle BIG DATA with no problem when using Graphene chips. The uses of Graphene chips and supercapacitors do not stop at BIG DATA. Someday there will be ultra-fast cell phones that only need to be charged for a few seconds every day. Supercapacitors will solve the electric energy weight problem. Airplanes will be able to run off of just electric power.^{3, 6, 8}



Graphene Supercapacitors

A supercapacitor is a type of energy source that is similar to a battery. Supercapacitors can be the same size as batteries but they store much more power. Supercapacitors also charge much quicker than batteries (charging fully in just a few minutes.) Integrating Graphene into the supercapacitors allows for them to be more efficient. Graphene Supercapacitors will be able to power all of the electrical components of Smart Bridges. The supercapacitors will seldom need to be briefly charged.^{3, 6}

Graphene Nanocomposites

Graphene nanocomposites are composite materials that integrate graphene flakes. These composite materials are much stronger and lighter than steel. This material will allow for easier transport and building because of its lightweight properties. However, strength of the material will not be compromised.⁴

Sources:

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