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Moder materials

Šimon Kovář
Deparment of textile and single-purpose machines

Division of modern materials:

- polymeric materials,
- Nanomateriály
- „HIGH-TECH“ – materiály
- Smart materiály:

Polymeric materials :

By to their properties (corrosion resistance, electroinsulating properties, noise and vibration damping, easy workability, low density), polymeric materials replace traditional construction materials. However, they have problems such as recycling and aging.

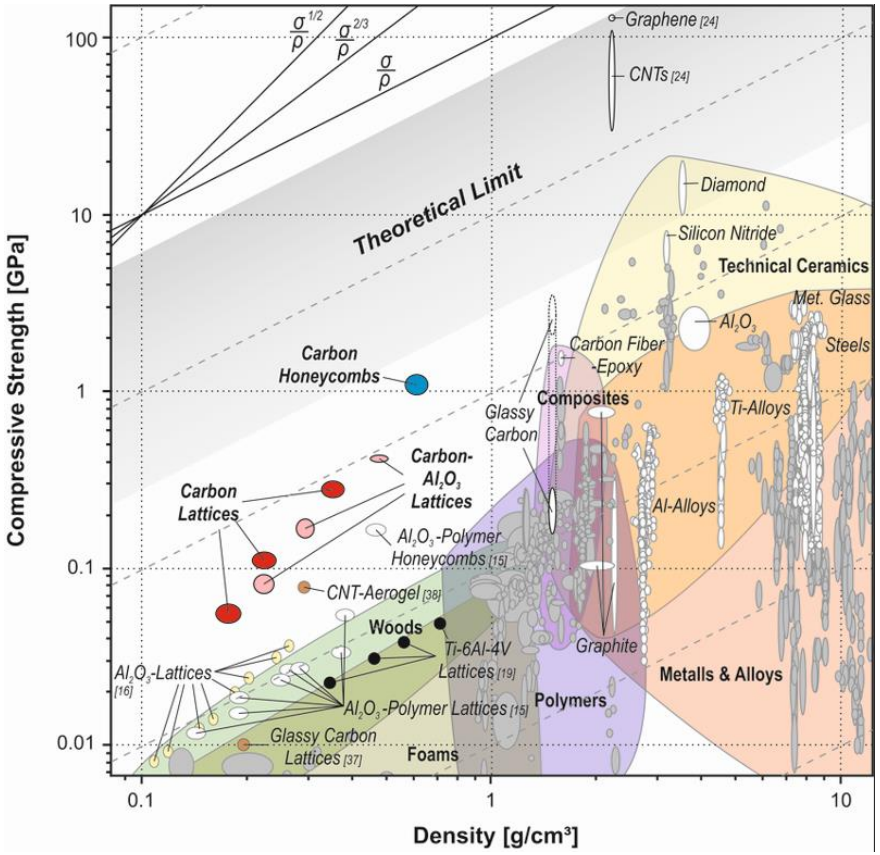
https://www.mmspektrum.com/clanek/plasty-jako-konstrukcni-material.html
https://www.mmspektrum.com/clanek/plasty-a-kompozity-naplnuji-materialove-pozadavky-moderniho-strojirens.html

Properties of plastics and composites

- Strength and modulus of elasticity approaching metallic materials.
- Better fatigue resistance than metals.
- High impact and notch toughness and resistance to crack propagation.
- High temperature resistance.
- Vibration damping ability.
- Ballistic properties.
- Inflammability.
- Barrier properties.
- Surface quality, no surface treatment required.
- Low or zero thermal expansion.
- Electrical conductivity.
- Corrosion resistance to highly aggressive environments.
- Recyclability.

Ashby's material maps

It is a new approach in the choice of construction material based on the ratio of mechanical characteristics for example to density.



Nanomaterials:

Nanomaterials are chemicals consisting of particles of min. in one dimension from 1 to 100 nanometers (nm). These particles can have unique optical, magnetic, electrical and other properties. They are used in engineering practice to improve surface properties, to improve mechanical properties, etc.

Classification of nanomaterials:

- One-dimensional - nanolayers, coatings, thin films
- Two-dimensional - nanofibers, nanotubes, nanowires
- Three-dimensional - nanopowders

http://projekt150.ha-vel.cz/node/132

https://echa.europa.eu/cs/regulations/nanomaterials

Disadvantages of nanomaterials:

Nanomaterials bring great benefits, but currently little is known about the negative effects on the environment and the human body. The manufacture of nanomaterials is subject to the health control regulations.

Examples of use:

TiO_2 – manufacture of paints, varnishes, plastics, ceramics, rubber, application of nanomaterials (metal oxides) has an antibacterial effect

http://www.szu.cz/uploads/Vzdelavaci_akce/CHPPL/KD130919/1_Zdravotni_aspekty_uziti_nanocastic_vcetne_nastriku_s_TiO2_Vit_M._Kotlik_B._SZU_Praha_.pdf

„HIGH-TECH“ - materials

The **“HIGH-TECH”** materials range includes composite materials, nickel alloys, new materials. New materials are metals, ceramics, plastics, titanium alloys. These materials excel in lower weight and better properties (corrosion resistance, wear, temperature load). Use especially in the automotive industry.

Smart materials:

Smart materials are intelligent or sensitive materials that have one or more properties that can be specifically targeted by an external stimulus (voltage, temperature, humidity, electric field, magnetic field, light, etc.). Examples are light-sensitive glasses, thermochromic fabrics, artificial muscle fibers (electro-active polymers), shape **memory materials**.
Form memory "**intelligent materials**" return to their original state after the external influence has subsided. In this way, traditional drives can be replaced. This helps to reduce weight, increase reliability and durability.

https://www.carnorama.com/1225/automotive-smart-memory-materials/

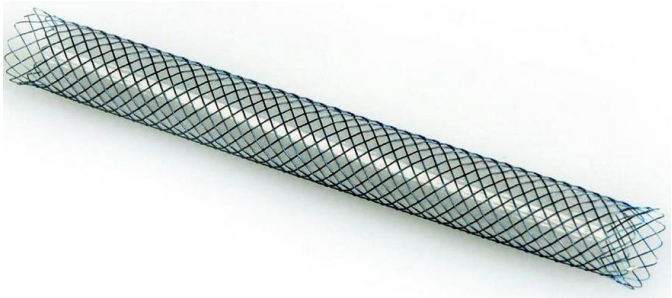
http://www.inuru.com/index.php/nove-zdroje/technologie/599-iteligentni-materialy-smart-materials

https://en.wikipedia.org/wiki/Smart_material

https://www.igus.cz/info/predictive-maintenance-smart-plastics?utm_source=igus+newsletter&utm_campaign=814b58e9ff-EMAIL_CAMPAIGN_2020_02_11_08_12&utm_medium=email&utm_term=0_20e499b6ec-814b58e9ff-222102457

Smart materials:

An example of a SMA shape-memory alloy is **Nitinol** - a nickel-titanium alloy. It is possible to change its shape. After heating to the activation temperature, the wire returns to the memorized state.



https://www.carnorama.com/1225/automotive-smart-memory-materials/

http://www.inuru.com/index.php/nove-zdroje/technologie/599-iteligentni-materialy-smart-materials

https://en.wikipedia.org/wiki/Smart_material

https://www.materialtimes.com/materialy/eko-bio-lca-recycled/hledani-hranic-smart-materialu-i.html

Conclusion

The development and application of new materials is the current trend. The most important area of use of these materials is transport, especially the automotive and aerospace industries. This is followed by the electrical, electrochemical, food and textile industries.

Questions:

- What materials we mean by „SMART MATERIALS”.
- What materials we mean by „HIGH-TECH MATERIALS“.
- Why we use „Ashby's material maps“.

Used literature and sources of information:

https://www.carnorama.com/1225/automotive-smart-memory-materials/

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