MEC-E1070 - Selection of Engineering Materials, Lecture, 4.9.2023-13.10.2023

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Started on	Monday, 4 September 2023, 9:58 AM
State	Finished
Completed on	Monday, 4 September 2023, 1:58 PM
Time taken	3 hours 59 mins
Grade	**3** out of 3 (**100**%)

Question 1

Flag question Mark 1 out of 1 Complete

What are some of your expectations from this course?

From this course, I hope to deep dive into material properties, where I can gain a thorough understanding of the various properties of engineering materials, from mechanical, damage to thermal properties. Then, I can confidently evaluate and choose the right material for any project.

Besides, I want the course to offer practical exercises or projects that allow me to apply theoretical knowledge in real-world scenarios, helping me bridge the gap between theory and practice.

Finally, I'm eager to learn about the latest advancements in material science, such as nanomaterials, laminate composite and functionally graded materials, to constantly stay updated in mechanical engineering.

Comment:

Question 2

Flag question Mark 1 out of 1 Complete

Choose a use case for a material, for example one of the parts of the standing rigging of a sailboat, where a new material enabled higher performance, and briefly explain how that material enabled higher performance compared to materials that were used earlier.

Example case: Laminated Lithium-Ion Batteries for Electric Vehicles (EVs)

Even though laminated batteries are still using lithium-ion based material, their new design has led to many novel applications. Normally, lithium-ion batteries usually have the cylindrical and prismatic designs. These designs are already carefully tested for the past decades and have been circulated in widespread applications for electronic devices. However, there exist many shortcomings in each design, such as packaging efficiency, suboptimal cooling rate and energy density [1]. Laminated batteries, on the other hand, have their cells stacked or folded into a flat, pouch-like shape. This design has gained significant attention, especially in the automotive industry for EV cars.

Performance Enhancement with Laminated Batteries compared to old designs [2]:

Packaging Efficiency: The flat, rectangular shape of laminated batteries allows for more efficient packaging, maximizing the use of available space within an EV. Meanwhile, prismatic batteries are usually big and not packaging efficient.
Improved Cooling: The design of laminated batteries allows for more uniform and efficient cooling. Cylindrical cells might not cool as evenly as laminate design
Lightweight: The absence of metal casings, as seen in cylindrical cells, means laminated batteries can be lighter, which is crucial for EVs to minimize their weights.
Real-world Application: Nissan's electric Leaf vehicle uses a laminated lithium-ion battery pack [3]. The laminate battery design was chosen by Nissan for the above reasons, which helps enhance their vehicle's overall range and performance.

Sources:
[1] https://blog.epectec.com/pros-and-cons-of-lithium-prismatic-cells-vs-cylindrical-cells
[2] https://batteryuniversity.com/article/bu-301a-types-of-battery-cells
[3] https://www.marklines.com/en/report_all/rep1786_201811

Comment:

Question 3

Flag question Mark 1 out of 1 Correct

In digital image correlation, a deformation field ✔ is iteratively applied to an image of a deformed object and numerically optimized, in order to minimize the change in pixel intensities ✔ relative to an image of the underformed object.

Your answer is correct.

The correct answer is:
In digital image correlation, a [deformation field] is iteratively applied to an image of a deformed object and numerically optimized, in order to minimize the [change in pixel intensities] relative to an image of the underformed object.

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