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New building materials

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While some might argue that the old ways are the best, the fact is that developments in the construction industry have made it easier and safer to build across the globe. The development of innovative new building materials has allowed architects to better realize their visions, as they make more daring structures possible due to their improved strength, flexibility and durability. This is the field that is developing all the time. If you want to stay on top of it, read on for a list of new building materials that might well be featured in our project. ***Graphene.*** While not a new material, graphene has been impractical to use in construction since its discovery. In theory, it is an excellent building material, as it is incredibly lightweight while being stronger and stiffer than both steel and carbon fiber. Potentially, it could be combined with more traditional materials. Graphene is so difficult to produce that builders have rarely been able to use more than a few flakes of it per project. Until now, that is, as the US' Oak Ridge National Laboratory has developed a new way of producing it using a technique known as chemical vapor deposition [1]. ***Roman concrete.*** The buildings and structures of ancient Rome have stood for a very long time, so the building materials they used must offer something to learn from. Now, researchers from Berkeley Lab at the University of California have made a breakthrough in cracking the secret of their long life - the special formula the Romans used to make their concrete. Unlike modern concrete, in which Portland cement to bind the

aggregate, Roman concrete uses a mortar mix of volcanic limestone, which reacts to form crystals that expand into the space within the concrete more effectively. This performs the function of microfibers in Portland-based concrete, but better - more resistant to corrosion, and packing the space more tightly. This also cuts the risk of microcracking in the concrete over time, extending lifespan considerably - 2,000 years and counting, as a trip around Rome will prove. Roman concrete is not just stronger than the modern version, it is also greener. The limestone and clay used in Portland cement needs to be heated to over 1,400 degrees Celsius in the manufacturing process, and this accounts for 7% of global carbon emissions. Roman concrete, on the other hand, needs nothing like this kind of heat, as the volcanic ash and lime they used reacts at a lower temperature. This means a potential new concrete formula that is stronger, greener, and longer lasting [2].

Natural concrete. Staying on the concrete theme, researchers from MIT have published a paper that proposes taking cement out of the equation altogether. The researchers, from the university's Department of Civil and Environmental Engineering, are looking to the natural world - proposing the use of organic materials like bones, shells and sea sponges to bind the aggregate in concrete together. The research is a fresh attempt to solve the twin drawbacks of Portland cement - the energy needed to make it, and the potential for microcracking over time. The idea came about when the team contrasted the extensive knowledge on the structure of natural materials with the 'guesswork' on concrete's internal structure - so it made sense to use more familiar materials in a 'bottom-up' approach to concrete production. 'Bone-create' is not a material ready to be used just yet - it is more of a starting point for engineers to change the way they choose the composition of building products.

Carbon-fiber balsa. Balsa wood is useful thanks to its stiffness despite being incredibly lightweight; however, it is difficult to produce and therefore expensive. However, a team of researchers at Harvard University have managed to create cellular composite materials of unprecedented light weight and stiffness that could replace it. Fiber-reinforced epoxy-based thermosetting resins and 3D extrusion printing techniques have been used to create the synthetic replacement. The researchers used these methods to create a 'honeycomb' effect in carbon-fiber epoxy materials. The end result is something that could potentially completely replace balsa wood. Not only would it be cheaper, it also eliminates the problems the wood has with irregular grains that make it difficult to use in precision structures [2]. ***Green-mix concrete.*** Developing new building materials is not just about making them stronger or lighter, but also about making them more environmentally friendly. A team from University Technology MARA in Malaysia has been able to create something that achieves this, with their invention of what they call 'green-mix concrete'. This uses conventional ingredients for concrete mixed with suitable waste and recycled materials to create an economical and eco-friendly substitute that still performs as well as the original. Some of the materials used include fly ash, recycled concrete aggregates and aluminium can fibers [1].

References:

1. Mode of access: https://www.worldbuild365.com/news/iet0guhii/building-architecture/new-building-materials-for-the-future-of-construction/. – Date of access: 28.04.2017.
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