Cement is a binding material that has contributed to the creation of historical monuments, but as we shift from 3000 BC into the twenty-first century, we can see the multitude of ways in which cement is being used. Today, the main ingredient in concrete is Portland cement, a new practice is mixing other materials with the Portland cement to enhance it. This process creates what is now called blended cement which may include fly ash, volcanic ash, and granulated slag.

These added agents serve to increase durability and reduce heat generation during the curing process. According to a case study, concrete is the second most used material after water, and although it seems like a well-established product, there is still a lot of room for improvement. Researches today are pushing the boundaries and creating new solutions for the construction industry. One of the ways they are doing this is by manipulating different agents within concrete to produce reusable energy.

Energy conducting cement

Electricity, a highly consumed energy source, is expensive and becoming more and more scarce. What if someone could implement a material that can conduct energy using cement? Mohamed Saafi, a professor from Lancaster University's Engineering Department, came up with a way to turn buildings, bridges, and even lampposts into batteries to decrease the cost of energy. The mixture is a potassium-geopolymetric (KGP) composite, the cement is composed of a fly ash and alkaline solution. The electricity is conducted via potassium ions that hop through the crystalline structure. According to the research, it can potentially store and discharge between 200 to 500W/m2. In addition to storing and omitting energy, the smart cement mixture can also sense imbalances, such as cracking, that can hinder the flow of potassium ions which can affect the structures conductivity.

Light generating cement

Dr. José Carlos Rubio Ávalos, a researcher at the University of Saint Nicholas of Hidalgo in Mexico, created a phosphorescent cement that can be used to illuminate highways, bike paths, and buildings without the use of electricity. The cement absorbs solar energy and emits it during the night for about 12 hours. Because of cement's opaque body, the researchers developed a way to eliminate the crystallization in cement to allow the passage of light inside. Therefore, absorbing solar energy and returning it to the environment as light. They focused on making the micro-structure of cement completely gel.

Nine years ago, when I started the project, I realized there was nothing similar worldwide,

and so I started to work on it. The main issue was that cement is an opaque body that doesn't allow the pass of light to its interior, - Dr. Rubio

The gel is ecological due to its sand, clay, or dust nature, in addition the process is ecofriendly as the only gas released during manufacturing is water vapour. The cement is said to have a life span of 100 years and it is currently being fabricated to emit green or blue light. The level of brightness can be adjusted during production as to not bother drivers or cyclists. The University of Saint Nicholas of Hidalgo obtained the first patent in 2016 and this product is in commercialization phase.

These innovations not only reduce energy consumption but also focus on producing environmentally friendly solutions that create less waste. Many researchers continue to find ways to make concrete more durable, eco-friendly and less prone to cracking, ergo these practices are shaping the industry for the better.

Related articles: Smart cement mixture turns buildings into batteries, How Concrete Can Reap Solid Environmental and Economic Benefits