



Louisiana EPSCoR

Louisiana Experimental Program to Stimulate Competitive Research

New, Eco-Friendly Material Serves As Sustainable Solution In Construction

Buildings and structures shape our physical landscape; they provide a better quality of life and guarantee our shelter and safety. Unfortunately, they are also one of the largest consumers of global resources and contributors to pollution emissions—which continues to rise as global construction booms.

However, research and recent innovations in the construction industry reveal solutions that could significantly slash the amount of energy used throughout the entire life cycle of a building or structure.

Research conducted by Dr. Erez Allouche, an Associate Professor of Civil Engineering at Louisiana Tech University, finds that if eco-friendly alternatives are used in construction materials, such as concrete, the technology could result in the development of a more sustainable construction industry.

Dr. Allouche’s research shows that investigating the properties of geopolymer binders in concrete (when used as an alternative to industry standard concrete binders) can lead to significant energy and cost benefits for many of its commercial applications. These developments can generate a safer and more profitable construction industry, and increase sustainability both during construction and throughout the life of a structure.

Concrete Binders: OPC vs. GPC

A building designed and constructed in a sustainable way minimizes the use of land, energy, water and materials, like concrete.

Concrete is the second most used processed material in the world by



Dr. Erez Allouche presenting at LA EPSCoR 2012 LA-SiGMA All-Hands Meeting on April 2 in Baton Rouge, LA.

weight, after water. The annual global consumption of concrete is 20 billion tons per year, or 3 tons for every person on earth, and carries a market value of approximately \$1.8 trillion.

Currently, ordinary portland cement (OPC) is the most common binder used in concrete. The production of OPC requires large amounts of energy, and has a large carbon footprint, contributing 3.6 billion tons of CO₂ per year, or 1 ton of CO₂ for each ton of cement produced, and emitting approximately 7% of the total global CO₂ emissions to the earth’s atmosphere annually.

Geopolymer cement concrete (GPC) is a relatively new material, with the potential to serve as a “green”

alternative to OPC in construction and commercial applications. Compared to OPC, GPC has a significantly lower environmental impact with approximately 90% less energy consumption and 85% less CO₂ emissions.

GPC also offers a higher mechanical strength and resistance to elevated temperatures (up to 2800°F) along with a corrosion resistance that is 8 times higher than OPC. This translates to an approximate 250-year design life. GPC is produced from a combination of fly ash (fine solid particles of ashes, dust, and soot carried out from burning fuel), sodium hydroxide and sodium silicate.

OPT-IN Program

Dr. Allouche’s research is supported by the Louisiana EPSCoR Opportunities for Partnerships in Technology with Industry (OPT-IN) program, and could potentially have a substantial impact on the construction industry, especially in Louisiana. The OPT-IN program is designed to promote meaningful university-industry partnerships while facilitating the commercialization of research and ultimately contributing to the economic development of Louisiana.

Impact On Louisiana

Louisiana is one of only five states in the U.S. that does not have an “in-



Geopolymer concrete offers a corrosion resistance that is 8-times higher than Portland Cement (illustrated above).

house” cement industry and thus imports all the cement that is needed for construction from neighboring states. Interestingly, approximately 8 million tons of fly ash is produced annually within an 8-hour driving radius of Louisiana’s capital city, Baton Rouge. Taking advantage of this resource, Dr. Allouche and Louisiana Tech, in collaboration with Cleco Power (an energy services company based in Pineville, Louisiana), are working on the development of commercial applications for geopolymer concrete made using fly ash from Dolet Hills Power Station in Mansfield, Louisiana.

Commercial applications developed at the facility range from pre-cast bridge barriers, parking stops to center blocks and sprayable grout for the rehabilitation of corroded sewer systems. Cleco Power and Louisiana Tech also announced that pilot



One of several pilot projects testing the durability of geopolymer concrete; shown withstanding rocket blasts at NASA’s John C. Stennis Space Center in Mississippi.

projects using geopolymer concrete are currently under way with multiple industry partners, with the hope of achieving commercial status within the next two years.



Dr. Erez Allouche is the technical director of the Trenchless Technology Center at Louisiana Tech University and holder of the T.L. James Eminent Scholar Chair in Civil Engineering. His research focuses on the development of new construction technologies, materials and design methods for underground utilities.

For more information about Dr. Allouche, his research or contact information, visit his faculty page at ttc.latech.edu/people/html/allouche.htm.

The **Experimental Program to Stimulate Competitive Research (EPSCoR)** is a federal-state partnership designed to build the science and engineering research, education, and technology capabilities in states that have historically received lesser amounts of federal research and development funding.

Louisiana EPSCoR is a catalyst for fostering university-industry partnerships that strengthen Louisiana’s scientific research and educational infrastructure, as well as contributing to the overall economic development of the state.

The **Opportunities for Partnerships in Technology with Industry (OPT-IN)** program is designed for full-time Louisiana faculty members in science and engineering disciplines seeking funding to partner with industrial entities to: build sustainable relationships between academia and industry; facilitate the commercialization of research; enhance research competitiveness; and contribute to the economic development of Louisiana.

For more information about Louisiana EPSCoR, the OPT-IN program or other funding opportunities, visit laregents.org or call (225) 342-4253.