# Innovative Green Concrete Technology for Enhancing Greenhouse Gas Reduction in Construction

Concrete is the most-used construction material in the world, and a leading contributor to global warming with 10% of industrial greenhouse-gas emissions. Production of cement, the primary component of concrete, is currently exceeding 2.6 billion tons per year worldwide and growing at 5 percent annually. Unfortunately, cement is a major source of atmospheric carbon dioxide because it is made by burning fossil fuel to heat a limestone and clay powder to 1,500 °C. When the cement powder is later mixed with water and gravel, the invested energy is released into chemical bonds that form calcium silicate hydrates, the glue that binds the gravel to make concrete. The decarbonation of limestone and the heating of cement are responsible for most of the greenhouse-gas output

In order to obtain sustainable green concrete, intensive researches have been recently conducted, not only on the geo-polymerization of the concrete, but also, and more importantly, on the reduction of the ratio of calcium-to-silicate, which is crucial in reducing carbon emissions in concrete manufacturing. The geo-polymerization process consists of inorganic polymer concrete utilizing fly ash, one of the most abundant industrial byproducts on earth, as a substitute for Portland cement. With regard to the ratio of the calcium-to-silica, the new finding reported the ratio of 1.5 to be the optimal one that makes the concrete highly green and two times more resistant than existing standard ones, in terms of mechanical resistance to fracture, since the cement would be glassier and less crystalline with no residual stress. In conventional cements, the ratio ranges anywhere from about 1.2 to 2.2, with 1.7 accepted as the standard.

Such double innovation has the benefits, not only to substantially curb CO2 emissions and to produce a more durable infrastructure capable of la sting hundreds of years, but also, conserve hundreds of thousands of acres currently used for disposal of coal combustion products, and protect our water ways from fly ash contamination as well.

Because of its improved resistance to mechanical stress, the new technology could be of particular interest to the oil and gas industries, where cement around well casings is crucial to preventing leakage and blowouts. In comparison with ordinary Portland cement-based concrete, the life cycle greenhouse gas of the geo-polymer concrete with a ratio of 1.5 for calcium-to-silica could be reduced by 90% according to the Technology Transfer Center in Shreveport (Louisiana, USA).

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