Vizag scientists find ‘positive features’ of irradiation on quartz crystals

The discovery opens up enormous opportunities for the cement-concrete industry, say scientists of Institute for Solid Waste Research & Ecological Balance

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The impact of radiation on concrete structures in nuclear power plants (NPPs) is causing frequent repairs, requiring rehabilitation of structures. The University of Tokyo published a paper on the impact of irradiation on concrete structures, by which the crystalline quartz, in aged concrete, is converted into amorphous state.

This is the negative aspect, affecting the soundness and durability of concrete. However, N. Bhanumathidas and N. Kalidas, founder directors of the Visakhapatnam-based Institute for Solid Waste Research & Ecological Balance (INSWAREB), during the course of their review on the subject, found certain ‘positive features of irradiation on quartz crystals’ which convert the non-reactive crystalline quartz to reactive amorphous silica. They interacted with the Scientists of University of Tokyo, and prepared a review report for the benefit of students, researchers and faculty.

“This opens up enormous opportunities for the cement-concrete industry,” say Dr. Bhanumathidas and Mr. Kalidas, who are involved in research on fly ash bricks and had developed fly ash, lime and gypsum (FAL-G) bricks as an alternative to clay bricks to reduce the threat of massive generation of fly ash by Thermal Power Plants (TPPs).

Commercial scope

The couple found during their review of the research findings that conversion of quartz from crystalline (unreactive) to amorphous (reactive) state through radiation is the

redeeming feature to benefit the cement and concrete industry with value addition of multibillion rupees, in addition to serving sustainable development goals.

“The crystalline quartz can be converted at commercial scale into amorphous silica by designing suitable reactors. If its reactivity is studied and established, such product can be used as complementary cement input to improve the quality. This will be more helpful where low grade limestone hampers the quality of clinker,” says Mr. Kalidas.

“By processing high-pure quartz, amorphous silica can be produced that may be akin to ‘silica fume’ whereby the value addition to cement and concrete could be potentially enhanced. By subjecting the coarse fly ash and pond ash to radiation in commercial reactors, the crystalline fly ash can be converted to amorphous ash to the extent of quartz content, rendering value addition to the inert ash. With over 2,860 million tons of ash in ash ponds occupying about 65,000 acres of land in India, this may prove the most sustainable avenue for exploitation in many aspects. The economic spin off is about ₹2.86 trillion in value addition of the product and ₹650 billion in reclaiming the land occupied by ash ponds,” he says.

“The NTPC has expressed its readiness to take up this project on a large scale once it is brought to a logical stage of implementation. Meanwhile, efforts are in progress to escalate the subject to the attention of the Prime Minister due to the criticalities associated with implementation of this project,” Mr. Kalidas told *The Hindu*.

“Ippei Maruyama of the UoT has also expressed willingness to partner in the research by INSWAREB, if the Government of Japan approves and funds it. He, however, wanted the Indian researchers to take care of activation by neutron, safety of material, and the running cost of the nuclear plant for the research,” he adds.

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