SMART GEOPOLYMERS, AN ERA-MIN PROJECT

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The SMART-G project proposes a valorization approach of Bauxite Residue (BR) and Construction Demolition Waste (CDW) which leads to the production of high added value smart insulation fire-resistant and photocatalytic novel materials for the construction sector. This is being achieved through materials engineering of secondary resources, novel manufacturing technologies such as additive manufacturing and smart manufacturing of building materials, and smart functionalization.
Bauxite Residues from alumina production have a 5 million tons production on dry basis per year in Europe, while CDWs approximately represent one third of the total waste generated by economic activities and households, which in EU-28 are about 2.5–3 billion tons per year. It contains a wide variety of materials such as concrete, bricks, wood, glass, metals and plastic.
The project idea originates from a combination of the existing proprietary knowledge and know-how of the consortium on: (i) geopolymerization which is an emerging technology with high potentials for the utilization of industrial solid wastes/residues to produce a low carbon cement/concrete replacement for the construction sector; (ii) development of thermal insulating and fire resistant geopolymers [1], (iii) additive manufacturing / 3D printing of geopolymeric pastes [2], (iv) foaming of geopolymers [3], and (v) integrated photocatalytic coatings with disinfecting and air cleaning functionalities [4], (vi) demonstrating the final products at an operational environment and testing their performance under real conditions in a demo-building upon project's completion. The final material is an insulating and fire-resistant material combined with a novel photocatalytic coating, for achieving air cleaning.

The involved partners are bringing proprietary know-how and expertise and offering private infrastructure and facilities, necessary for this implementation. In particular, the industrial partner, Aluminium of Greece, acts as industrial residues (metallurgical slag/ bauxite residue) provider, while the industrial partner, Przedsiębiorstwo Budowlano-Produkcyjne Łęgprzem Sp. z o.o provides the CDW waste. The knowledge and know-how offered by three Universities (University of Aveiro, Portugal; Cracow University, Poland and Vrije Universiteit Brussel, Belgium) and one Research Center (Foundation for Research and Technology-Hellas, Greece) comprise a very important background for the successful implementation of the project. Core asset for this achievement is that in addition, pilot-plant facilities are offered via the SMEs involved in the project (Resourcefull, Belgium; MNLT, Greece), as well as the pilot-scale infrastructure of the FORTH Research Center.

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