

Leganti inorganici per stampa 3D di componenti ceramici di grande dimensione

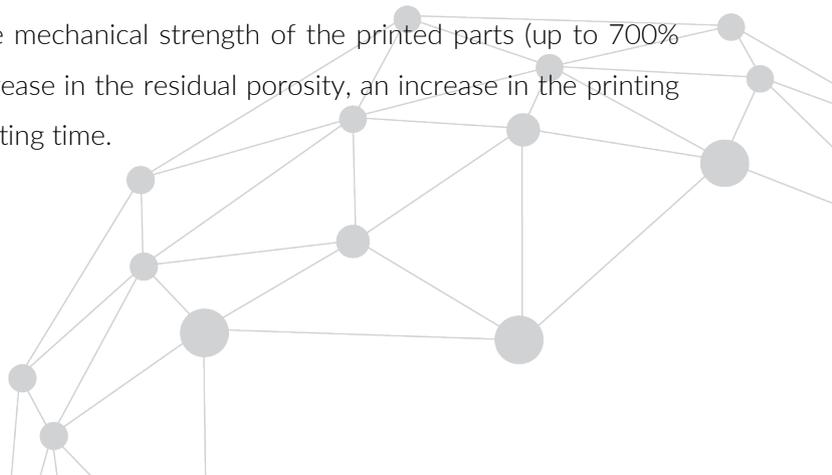


Description of the invention

Our researchers, in collaboration with the company Desamanera, have developed fast-reacting inorganic hydraulic binder systems that enable the production of large scale components (up to 6x6x6 m in size) using a specific Additive Manufacturing technique (indirect 3D printing of a ceramic powder bed). This invention leads to components suitable for a wide number of applications, ranging from architectural and artistic elements to functional components for the building industry or other industries, including bespoke refractory shapes. In particular, the binders are capable of operating at high temperatures (up to ~1500°C) because they are converted into suitable ceramic phases upon heating. This invention overcomes the issues associated to a previously used non hydraulic binder system, which was limited in terms of durability to aqueous environments and applications at a temperature above room temperature. The patents include a description of a 3D printer for additive manufacturing of large scale components.

Which need does it respond to?

These binder systems allow for the improvement of the properties of the printed parts, making them suitable for applications in which there is a permanent contact with a water-containing environment or the temperature of use is higher than room temperature. In particular, the use of the novel, optimized binder systems leads to a large increase in the mechanical strength of the printed parts (up to 700% with respect to the current technology), a decrease in the residual porosity, an increase in the printing resolution and a significant decrease in the printing time.



Market size and Application

The invention, together with the use of a proprietary printer, is the only one currently enabling the Additive Manufacturing of large scale components using an indirect 3D printing technology. The only alternatives concern the direct printing (e.g. by extrusion or spraying) of OPC (ordinary cement)-based components. Indirect printing technologies are more suited to the fabrication of objects with complex structure and morphology, including the presence of large overhangs and voids within the printed body. The potential applications are numerous, ranging from artificial reef structures to outdoor architectural components, from the reconstruction of lost artifacts (in a 1:1 scale) to bespoke refractory shapes. Examples of uses include:

- Artificial Reef structures – The developed binders allow, through AM, easy implementation of coastal protection elements (Reef), emerged and submerged, with performance characteristics designed to meet the specific needs of a given coastal environment. The neutral environmental impact of production materials make our Reef ideal for the use in marine habitats with protected flora and fauna.
- Outdoor/Indoor Architectural Components – The developed binders give the possibility to conceive and build components for external architecture in complete creative freedom with shapes and innovative architectural and structural solutions that open the door to a new era of urban planning.
- Refractory Materials – Also in the field of refractory materials, the use of the developed binders combined with to AM technology, allows to innovate the sector. In addition to the simplicity and speed of production of complex, large size shapes, the production costs also can benefit from the use of AM technologies.
- Heritage: In the field of reconstruction and recovery of artistic and archaeological heritage, the new binders greatly amplify the ability to reproduce lost or destroyed works. The possibility of using the same materials with which the original artifact was built coupled with the reproduction accuracy, low cost and numerous other benefits (weight, performance, quantity reproduced) allow, in addition to the recovery, a fruition of the Art and Cultural heritage open to a much wider audience.

Commercialization and Advancement status

The company Desamanera has started using the developed binder systems, and further optimization work is currently being carried out. The company is seeking industrial partners to further support and extend the commercialization of the technology.

Titolarità del brevetto

Università di Padova – Desamanera Srl

Inventore Proponente

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Status del brevetto

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Domanda di brevetto italiana n. 102015000071593 depositata il 11 novembre 2015

Disponibilità alla licenza

Italiana

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