

INNOVATIVE PROCESS TO OBTAIN CELLULAR MATERIALS APPLIED TO BUILDINGS WITH NEW FUNCTIONALITIES

P PATENTED TECHNOLOGY

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ABSTRACT

A Spanish researcher has developed a new process to obtain cellular materials that can be applied in different sectors. It can be used with polymers, ceramic, concrete, glass or composites without changing its chemical composition.

It is easy, cheap and doesn't need any specific machinery. The materials obtained have a lot of advantages and very good mechanical and functional properties. Researchers are looking for companies interested in licensing the patent for its commercial exploitation.



INTRODUCTION

The cellular materials are characterized by several pores in the internal structure interconnected or not. Nowadays two methods are used to obtain cellular materials:

1. Synthetic foams are mixed with the material and air micelles are formed and covered by the material. This method presents several **disadvantages**:

- The material has a variable chemical composition
- The foam needs big volume to be processed
- High logistic costs
- Specific machinery to manufacture the cellular material. The foam needs high pressure pumps.
- It is impossible to manufacture the material in situ.

2. Aluminium powder and lime are added to the material. A chemical reaction with water produces hydrogen. The hydrogen gas foams and doubles the volume of the raw mix, creating gas bubbles. At the end of the foaming process, the hydrogen escapes into the atmosphere and is replaced by air. This process has some **drawbacks**:

- Lime is corrosive so it can not be used with all materials.
- Hydrogen is explosive in contact with air. Special facilities are needed to manage the hydrogen.
- The chemical composition of the raw material is modified.

TECHNICAL DESCRIPTION

The Spanish researcher has developed a **new method to obtain cellular materials** that overcomes all the disadvantages of the methods currently used.

The raw material is mixed with a liquid compound (hydrogen peroxide, H₂O₂). This liquid breaks down generating water and oxygen gas. The decomposition can be spontaneous or assisted. The generated oxygen is trapped in independent cavities in the material matrix, changing its physical structure without variation in its chemical composition. This change in the material structure changes the mechanical properties too.

The infiltration of the hydrogen peroxide in the material can be made in several ways. The cheapest and fastest one is simple diffusion in water. If the hydrogen peroxide doesn't break down spontaneously, the decomposition can be assisted by light and heat. For this purpose, sunlight has enough power to produce H₂O₂ decomposition and is cheap and ecofriendly. In the same way, sunlight can be used to dry the material after the process, unless a fast drying is needed. In that case autoclave can be used.

Cellular materials can be polymeric, ceramic, cement or glassy nature, but in every case the process to obtain them is the same. Oxygen bubbles are formed inside the material by hydrogen peroxide decomposition. These bubbles create independent cavities. The variables of the process can be modified attending to the customer requirements to obtain materials with specific properties.

Example:

Method to obtain cellular concrete to be used in buildings, maintaining the original chemical composition of the concrete. Firstly, water is introduced into the mould to wet the walls. Hydrogen peroxide is added and after this, the concrete. The mixture must be stirred during one minute. A variation in the stirring time can modify the volume and the mechanical resistance, so it can be optimized to obtain the desired properties. Finally, the mixture must be set for 3 hours. With this method the surface has cellular appearance. This can be avoided impregnating the mold previously with no cellular concrete, to create a no cellular film on the surface on the cellular concrete. With 400 g of concrete, 500 mL of water and 15 mL of H₂O₂, one liter of cellular concrete can be obtained.

The described process can be applied to different materials optimizing the variables to obtain the amount, shape and size of porous needed in each case.

TECHNOLOGY ADVANTAGES AND INNOVATIVE ASPECTS

- The resultant porous material doesn't change its original chemical composition but changes its physical structure.
- Very low production cost.
- Lightweight materials are obtained.
- Insulating materials can be obtained.
- Porous can be used to introduce some chemicals in the material to give it certain properties (for example, flameproof).
- The obtained materials can float in water.
- Special machinery is NOT needed to process the materials.
- The cellular material can be produced in situ.
- Easy manufacturing process without dangerous chemicals involved.
- This technology can be applied to a lot of material like polymers, concrete, gel, composites, etc.

Cellular materials are a new and attractive materials class with interesting applications in different sectors.

CURRENT STATE OF DEVELOPMENT

The first prototypes of cellular concrete have been manufactured at laboratory scale. To scale up the process to industrial production is viable, but nowadays there isn't any production line running. The conditions of the process will be different according with the specific needs of the sector which the cellular material will be applied for.

MARKET APPLICATIONS

With this kind of materials can be satisfied the new requests of the market in new engineering and technological applications like:

BUILDING:

- Cellular materials for building and thermal and acoustic insulations.
- Cellular concrete for buildings with different shapes and sizes and with the original chemical composition of the concrete.

TECHNOLOGY:

- Cellular materials to thin layer processes. Thin layers can be obtained between the cellular structures of the matrix.

COLLABORATION SOUGHT

Companies interested in acquiring this technology for commercial exploitation are sought.

INTELLECTUAL PROPERTY RIGHTS

This technology is protected by patent.

- Application Number: P200701648
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MARKET APPLICATION (4)

Construction and Architecture
Materials and Nanotechnology
Stone and Marble
Chemical Technology