INDUSTRIAL MANUFACTURING, MATERIAL AND TRANSPORT Technology Offer

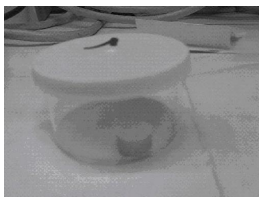
An experimental process for porous glass production starting from Cathode Ray Tube (CRT) waste glass

(08 IT 55X8 0JEA)

Abstract

An Italian university research group has experimented a thermal process aimed to the production of porous glass from dismantled Cathode Ray Tubes (CRTs). The porous glass, suitable for thermal and acoustic insulation, represents an interesting application for CRT waste glasses from an economic and environmental point of view. The team is looking for industrial partners interested in the further improvement of the process, with attention to the achievement of adequate material properties.

Description



Cathode Ray Tubes (CRTs) contain mainly two types of glass (funnel and panel), welded together with a lead frit. In colour equipments, the funnel contains a significant quantity of lead oxide (18–20% in weight), and present a carbon coating on the inside. The panel, instead, is characterized by high levels of barium oxide (9–11% in weight) and strontium oxide (8–10% in weight) and it is coated with a matrix of thousands of tiny phosphor dots, constituted by chemicals which emit light when excited by a stream of electrons. Furthermore, a significant presence of iron characterizes CRT glass, which must be reduced to let glass recovery in open-loop scheme. In-depth investigations need to evaluate the feasibility of open-loop recycling scheme, to consider technical features, quantities, environmental implications and economic considerations and to find out new applications for recycled CRT glass.

A thermal process has been experimented at laboratory scale aimed to the production of porous glass starting from glass panel from waste CRTs. The experimented process determines the formation of gaseous elements thanks to the addition of foaming agents, like calcium carbonate, under different operative conditions.

The waste glass was finely ground (top size <75 µm,-micron-, ca) and added with calcium carbonate (1% in weight) and water (15% in weight). The mixture was homogenised, divided in samples and then compressed in the form of tablet. After a drying process at 80 °C for 24 h, the samples were subjected to thermal treatment at a heating temperature of 725 °C for a holding time of 10 min. Then, the samples were drastically cooled (about 10 °C/min) to room temperature.

The apparent density of the samples decreased drastically, from 1.7 g/cm3 to 0.64 g/cm3 after processing.

Further development of the research project will be aimed to:

- verify the results obtained under different operative conditions:
  - addition of different percentage in weight of foaming agents;
  - addition of different foaming agents (sodium carbonate, silicon carbide and titanium nitride);
  - variation of holding time;
  - variation of heating temperature;
  - variation of the cooling rate;
- verify the properties of the porous glass obtained:
  - porosity (both by physical methods and by scanning electron microscopy and image analysis)
  - insulation;
  - mechanical properties.

Innovations and advantages of the offer

The proposed process allows the preparation of a novel glass material suitable to be reintroduced in an open-loop recycling system as a high-quality secondary raw material.

The foaming processing consists of the formation of gaseous species in a mass of softened glass powders undergoing viscous flow sintering. Unlike previous researches, gasses production is due to the chemical reactions of the foaming agents inside the glass powder, simultaneous to sintering.

The use of a recycled material (waste glass from CRT) is an interesting industrial application from an economic and environmental point of view. From an economic point of view, the cost of a recycled material

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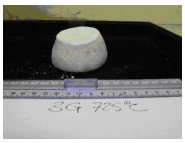
is significantly lower than the cost of raw material necessary for the same application. Furthermore, the work temperature of the heating processing (about 725 °C) is lower than the melting point of glass: this avoids oxides volatilisation and leads to a certain economic advantage. The energy consumption, in fact, is lower than in other treatment of waste glasses, such as vitrification. From an environmental point of view, the proposed process accomplishes the European hierarchy on waste management, preventing the landfilling of huge quantities of waste materials deriving from Waste Electrical and Electronic Equipment (WEEE). The cathode ray tube (CRT), in fact, represents about 66% in weight of television sets and computer monitors and consists for 85% in weight of glass.

Current and Potential Domain of Application

- manufacturing of ceramic products
- recycling industry
- plastic manufacturing industry



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