CERAMIC STRUCTURES AND PROCESS FOR PRODUCING THE SAME

BACKGROUND OF THE INVENTION

This invention relates to a ceramic structure to be used in, for example, waste gas purification means for automobiles, and to a process for producing said structure.

A conventional ceramic structure has been produced according to a process carried out, for example, in such a manner that substrates composed of cordierite or mullite subjected in primary firing are laminated to each other so as to form between the substrates fluid passages through which waste gases, air, etc. are passed, and the laminated substrates are subjected to a second firing to form a ceramic structure, which is then coated with a substance having a large specific surface area such as, for example, γ-alumina (γ-Al_2O_3) or the like, thereby increasing the specific surface area of the ceramic structure. According to said process, however, there have been such drawbacks that the uniform coating of the said substrates with the substance having a large specific surface area is difficult, and if the substance having a large specific surface area is coated thickly, and if a mechanical or thermal impact of, for example, about 30G (G: 9.8 m/sec^2) is applied to the said ceramic structure, the layers comprising the substance having a large specific surface area comes off from the said substrates.

With an aim to overcome the above-mentioned drawbacks, the present inventors made extensive studies to accomplish the present invention.

An object of the present invention is to provide a process for producing a ceramic structure coated uniformly with a porous substance and excellent in resistance to mechanical and thermal impacts which comprises a first step in which optional-shaped substrates composed of a ceramic material are subjected to primary firing, a second step in which the said substrates are coated with a substance capable of being made porous by secondary firing, a third step in which the said substrates are laminated to each other so as to form fluid passages between the substrates, and a fourth step in which the laminated substrates are subjected to secondary firing to chemically bond the said substrates to form a unit structure by means of the said substance capable of being made porous.

Another object of the invention is to provide a ceramic structure excellent in resistance to mechanical and thermal impacts which comprises substrates composed of a ceramic material and porous ceramic layers formed on the substrates, the pores of said ceramic layers having been filled with an alumina type ceramic having a large specific surface area.

A further object of the invention is to provide a process for producing an inexpensive ceramic structure which comprises a first step in which a ceramic material is shaped into flat and wavy substrates, a second step in which the flat and wavy substrates are immersed in a mixed slurry comprising an organic material and a ceramic material, a third step in which the immersed substrates are alternately laminated, a fourth step in which the resulting laminate is fired at a high temperature to prepare a construction, and a fifth step in which the said construction is immersed in an alumina type ceramic solution and then fired to firmly adhere the alumina type ceramic to the pores and surface of said construction, wherein the firing temperatures of the flat and wavy substrates and the mixed slurry are close to each other, so that two of the production steps can be reduced to one to make it possible to produce the inexpensive ceramic structure.

A still further object of the invention is to provide as a modification of the above-mentioned process, a process for producing a ceramic structure which comprises a step in which a ceramic material is shaped into flat and wavy substrates, a step in which the flat and wavy substrates are alternately laminated and then fired at a high temperature to prepare a construction, a step in which the construction is immersed in a mixed slurry comprising an organic material and a ceramic material, a step in which the immersed construction is fired, and a step in which the construction is immersed in an alumina type ceramic solution and then fired to firmly adhere the alumina type ceramic onto the surface of the said construction, wherein the production operations are easy and the ceramic structure as a final product is favorable in yield.

In the accompanying drawings,

FIGS. **1** and **2** are longitudinal sections of the flat and wavy substrates coated with a substance capable of being made porous by a second firing which were obtained after completion of the second step of the first-mentioned process of the present invention;

FIG. **3** is a longitudinal section of the ceramic structure obtained after completion of the fourth step of the above-mentioned process of the present invention;

FIG. **4** is a longitudinal section of the ceramic structure obtained according to another process of the present invention; and

FIG. **5** is an enlarged longitudinal section of the portion A of the ceramic structure shown in FIG. **4.**

The present invention is illustrated below with reference to the drawings.

The construction of the ceramic structure produced according to the first process of the present invention is as shown in FIG. **3,** in which **1** is a flat substrate, **2** is a wavy substrate, **3** is a bonding layer composed of a substance capable of being made porous which firmly bonds the said flat and wavy substrates **1** and **2** to form a unit structure, and **4** shows fluid passages provided between the said flat substrate **1** and wavy substrate **2** through which waste gases, air, etc. are passed.

The present process for producing a ceramic structure of the above-mentioned construction is explained below.

First embodiment:

In the first step, a mixture comprising 3 kg of a glass ceramic powder, 500 g of phenol resin and **1** liter of alcohol is flowed into flat and wavy molds and then subjected to primary firing at 500° to 1,200°C, preferably 900°C, for 1 hour to obtain flat and wavy substrates **1** and **2.** In the second step, each of the upper and lower sides of the above-mentioned flat and wavy substrates **1** and **2** is coated with a mixture comprising 3 kg of aluminum hydroxide, 100 g of phenol resin and 1 liter of alcohol to form a layer of 0.2 mm thickness. In the third step, the coated flat and wavy substrates **1** and **2** are dried at 220° to 230°C. to vaporize the alcohol, coated with a binding material comprising the above-mentioned glass ceramic powder-phenol resin-alcohol mixture, and then laminated to each other. In the fourth step, the laminated substrates **1** and **2** are subjected to a second firing at 500° to 1,600°C, preferably 900°C, for 5 hours, for example, whereby the alcohol is vapor-