TA5010 - Simulation of sintering condition for ceramics

Introduction

The sintering process of ceramics part is divided into debinding and sintering. In TMA, it is possible to measure the material sintering temperature and shrinkage due to sintering. Thus, TMA is used as simulation of sintering process for ceramics part.

Moreover, in Dynamic TMA, it is possible to make the sintered object by a certain shrinkage rate, which is performed at the controlling temperature with the shrinkage rate.

Instrument

TMA adopts the Rigaku's establishment reputation on differential expansion principle where the thermal expansion or shrinkage generated from the detection mechanism itself can be cancled. It offers high accuracy and excellent reproducibility in expansion and shrinkage measurements, even with low expansion materials or thin materials.

Dynamic TMA unit

Dynamic TMA is a temperature control method in which the sample's shrinkage associated with sintering is measured not by constant heating rate but the heating rate continuously changes depending on the sample's shrinkage rate. Thru this temperature control, the temperature program simulation can be applied to inhibit grain growth and obtain a sintered material.

Measurement and analysis

Sintering process of heat-treated AI_2O_3 powder for debinding by employed TMA is shown in Figure 1 The measurement is observed that it started the sintering at around 1000°C, when it completed, its shrinkage ratio was around 16%.



Figure 1: TMA measurement result of constant heating at 10°C /min, holding 100 min at 1500°C

In Dynamic TMA, it controls the temperature for shrinkage rate as parameter. Sintering process of heat-treated AI_2O_3 powder for debinding by employed Dynamic TMA is shown in Figure 2.

It is observed that the material was holding constant shrinkage rate. In Dynamic TMA, it is enabled to make the sintered object by setting intended shrinkage rate. It is available to evaluate the good sintering conditions by performing the sintered objects of physical property test which the samples made in several conditions of shrinkage rate by employed Dynamic TMA, because it has possibilities that the particle density of ceramic after sintered depends on the heating condition. Moreover, observing the temperature curve of measurement, the temperature condition of shrinkage rate at sintering can be known.



Figure 2: Dynamic TMA measurement result of constant reaction control at 0.02%/min, holding 100 min at 1500°C

Related products



TMA8311/HUM

TMA/HUM measures change in dimension or mechanical p roperty of a sample while subjected to a temperature regim e under water vapor atmosphere with a constant relative hu midity.