Forming of Ceramic Powders by new Forming Method, Cyclic CIP

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Abstract

The powder compaction is one of the most important process in making fine ceramics and has great effect on the feature of products. The most popular powder-forming process is the dry uni-axial pressing. A compact made by this method is apt to have inhomogeneitic packing zones. Therefore a lot of methods, e.g., vibratory uni-axial pressing or CIP, have been developed to make a dense and homogeneitic compact.

The authors have developed a new powder-forming technique, called "Cyclic-Cold Isostatic Pressing (C-CIP)", by superimposing cyclically varing pressure on to a static hydraulic pressure, introducing both easiness of movement of particles by vibratory pressing and homogeneitic forming by CIP. Using this method, we found that the green density of compact increased remarkably in comparatively low pressure. The structural reliability of sintered alumina after C-CIP considerably increased.

At the present time, silicon carbide is one of the candidates for the structural material which is expected for practical use under a high temperature. However, low sinterability originated in its tight covalent bond makes it difficult to make a product that has high structural reliability. Commonly silicon carbide is made by hot pressing or hot isostatic pressing to make a dense sintered body, however, these methods have some disadvantages; restricted shape of compact and large scale machine. Under these circumstances, normal pressure sintering of silicon carbide has been developed, which needs dense and homogeneous compact.

In this study, alumina powders were formed by C-CIP and the effects of C-CIP parameters were examined. Also, silicon carbide powder was formed by C-CIP and sintered under normal pressure. The effect of this method was discussed on the structural reliability of strength.