Dry Pressing and Properties of Granular Material for Pressing

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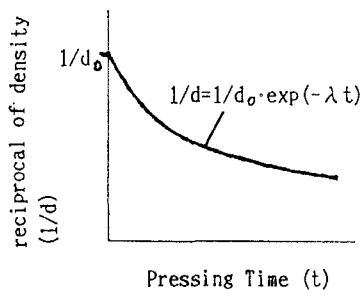
Ceramics used in recent electronics are fed as elements to machine for electrode printing, for example, automatically, so the mechanical shape and dimensions of ceramics are required to be within very precise tolerance to match with the machine. This requirement for ceramics applies to other industry use as well.

But, up to now it is very difficult to insert just fired ceramics in machines, taking into account mechanical accuracy. The shape and dimensions of ceramics depend on both processes of forming and firing. Dependence on the firing process is great, as it causes considerable shrinkage to the ceramics during the solid chemical change. So, it is controlled by the firing shrinkage. In this case, during the forming process the same formed body have to be made every time. To make the same formed body industrially, it is necessary to control the body density. But, taking note of the density of each part of the body, each parts density depends on the properties of the granular material to be used in dry pressing. Therefore, it is necessary to study how are the granule properties causing variations in the density of each part, resulting in the shape defects or dimensional variations of ceramics.

As a result of studying, the summary of requirements properties [1] for granular material is as follows. 1.(1) To be superior free flowing. For the purpose of it, (2) To be globular, and (3) To be uniform size, and then, (4) To be high density for each granule. Globular granule with free flowing is made by spray dryer, in case of fit drying conditions [2] only. 2.(5) To let granule size meet to forming body. 3.(6) To have proper mechanical strength. The model is supposed, the reciprocal of density of body to be formed decreases according to pressing as showed in the figure. In initial pressing, granules in forming mould shift to closed packing [3]. If a part of granules is broken in order to low strength, pressure doesn't transmit between granules mutually. (7) To be broken in a middle period of pressing. After pressing, air between granules run away perfectly. As a result, broken pieces of granules join together. Formed body with remained air will be appear defect after firing. 4.(8) To have a proper water content. Granule with much water content is easy to stick to mould. Granule with little water content is very strong, so it dosn't be crushed by pressing. Additionally, practical example [4] on improved properties of granular material for ceramic production is reported.



Ref. 1) H.Yamamoto: Electoronic Ceramics, 6, 17 (1975), Ceramics, 18[11] 978 (1983) 2) H.Yamamoto: Ceramics, 2[4] 277 (1967) 3) Y.Shiraki: Ceramic Gairon(2),Japan Ceramic Society (1963) p.22 4) H.Yamamoto & T.Horiuchi: Ceramics, 5[4] 277 (1970)