

Reference Sintered Materials for Grinding
(Al₂O₃ Sintered Material)

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1. Introduction

Advanced ceramics have excellent properties, and they have been expected as new industrial materials. In order to use them as reliable as common materials, the brittleness has to be conquered, and the manufacturing cost has to be reduced.

One half of the product cost of advanced ceramics is grinding. The researches are being done in many fields to reduce the grinding cost. However, test pieces of advanced ceramics are not standardized or normalized enough their properties. And the manufacturing processes are not opened to public. The different maker or process shows different microstructure as shown in Fig.1. Therefore it is hard to compare the grinding test results each other. It is strongly hoped to distribute the reference sintered bodies which can evaluate the grinding machines and tools.

Japan Fine Ceramics Center(JFCC) has been developing the reference sintered materials. At the beginning, JFCC

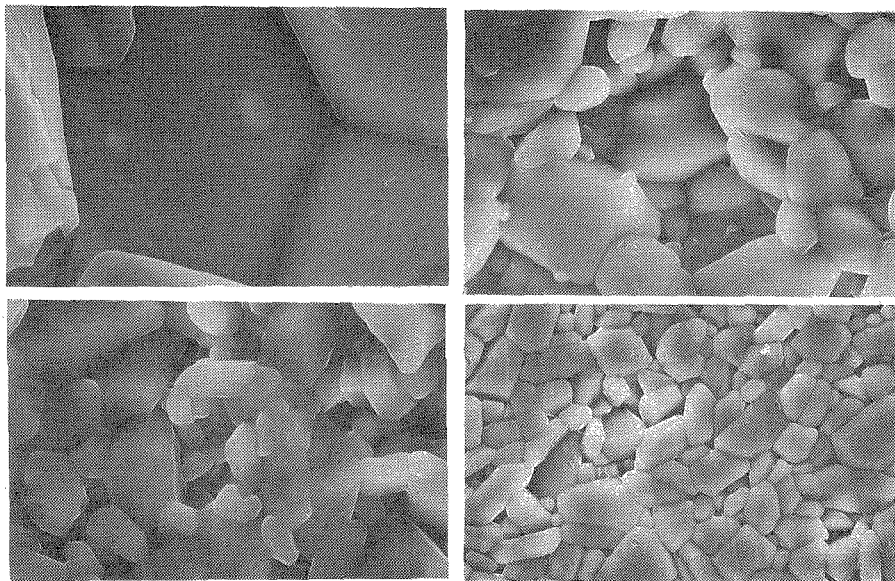


Fig.1 SEM micrographs of commercial available Al_2O_3 ceramics $5\mu\text{m}$

had a questionnaire concerning reference sintered materials in grinding fields. According to the questionnaire, Al_2O_3 sintered body has been developed as the first reference sintered material.

The followings are the features of reference sintered materials named REFERCERAM.

- (1) Equivalent or more superior than commercial available Al_2O_3 ceramics in properties.
- (2) To be opened manufacturing process.
- (3) To be controlled the properties well.
- (4) To be stable supplied for the long terms.

2. Results of the questionnaire research

The questionnaire was carried out from June to July in 1988. About 60% of the questionnaire was replied and 80% of

the reply demanded to supply the reference sintered materials for grinding.

The demanded materials as the reference sintered materials for grinding are shown in Fig.2. The most

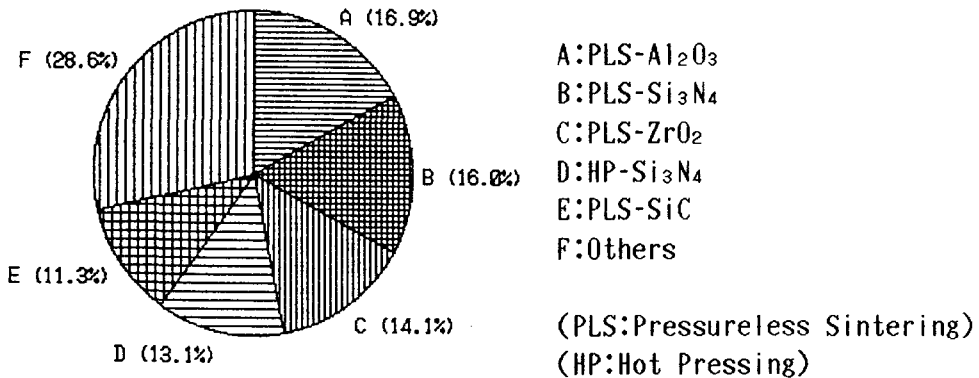


Fig.2 Demanded materials as the reference sintered materials for grinding

demanded sintered material is Al_2O_3 and the second material is pressureless sintered Si_3N_4 .

The required information concerning the reference sintered materials are not only the properties but also the processing.

The questionnaire asked about grinding equipments and conditions (grinding machines, wheels and so on), but they are omitted in this paper.

The reference sintered materials for the testing of the mechanical and thermal property were also required as

well as grinding.

3. Development of Al_2O_3 reference sintered material for grinding

According to the result of the questionnaire, at the beginning JFCC started the development of Al_2O_3 reference sintered material. The aims of the developing Al_2O_3 reference sintered material are followings;

- (1) To be stable quality.
- (2) To be top level of the commercial available Al_2O_3 ceramics.

At the first, the effect of additive on sintered properties and sintered microstructure was investigated, and the amount of additive was optimized¹⁾. At the second, we investigated effect of doping binder in mass-production scale²⁾. The mass produced sintered materials were distributed to the monitors who belonged to universities and

Table 1 Main properties of Alumina sintered material

Density	3.92 g/cm ³
Fracture Toughness	4.3 MPam ^{1/2}
Flexural Strength	350 MPa
Hardness	1600 HV 10
Thermal Conductivity	30 W/mk
Chemical Composition	(wt%)
	$\text{Al}_2\text{O}_3 > 99.7$
	MgO < 0.1
	$\text{SiO}_2 < 0.1$
	$\text{Na}_2\text{O} < 0.05$
	$\text{Fe}_2\text{O}_3 < 0.02$

public research institutes.

The main properties of Al_2O_3 reference sintered material are showed in the Table 1 .

JFCC, Asahi Glass CO.,LTD.(AGC) and Sumitomo Chemical CO.,LTD.(powder supplier) had had technical meeting until the mass-production process and its conditions were established. AGC is producing the sintered Al_2O_3 by the established process, and JFCC is distributing them as REFERCERAM. JFCC is also planning to spread the manufacturing process. To spread the manufacturing know-how as possible as we can is another significance of this project.

4. Development of this project

- (1) Distributing another materials such as Si_3N_4 , Zr_2O_3 , SiC , etc. and adding another grade for each material.
- (2) Building up the data-base such as manufacturing know-how and mechanical, thermal, machining, grinding and chemical properties.
- (3) Distributing the data-base.
- (4) Expanding usage, after reducing the variance of the properties.

References

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