GOVERNMENT COLLEGE OF ENGINEERING AND CERAMIC TECHNOLOGY

Established 1941

Accredited by NAAC with Grade A

(2015)

73, Abinash Chandra Banerjee Lane

Kolkata-700010

West Bengal, India

E-mail: gcectwb@gmail.com

3.3: Innovation Ecosystem

IPR Cell

GOVERNMENT OF WEST BENGAL
Govt. College Of Engineering & Ceramic Technology
(Formerly College Of Ceramic Technology)
Government of West Bengal
73, Abinash Chandra Banerjee Lane, Kolkata- 700 010
Tele/Fax-2370 1264, E- Mail: gcectwb@gmail.com

Memo No: GCECT/1550/2021-22 Date: February 16, 2022

OFFICE ORDER

A Committee of I.P.R. Cell has been constituted with the following members:-

1.	Dr. Sankar Ghatak	:	External Expert, Former Scientist CSIR – CGCRI.
2.	Prof. Rituparna Sen	:	HOD (CT) – Convener
3.	Prof. Mausumi Maitra.	:	HOD (IT) - Member
4.	Dr. Kalpana Saha.	:	HOD (CSE) - Member
5.	Dr. Kaberi Das.	:	Member
6.	Dr. Partha Halder.	:	Member
7.	Dr. Barun Kumar Sanfui	:	Member
8.	Dr. Alok Mukherjee	:	Member
9.	Dr. Kingshuk Chatterjee.	:	Member

The Committee will start its functioning with immediate effect.

Principal
Govt. College of Engineering & Ceramic Technology
Govt. of West Bengal

Incubation Centre

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K. Chakd/

Principal
Govt. College of Engineering & Ceramic Technology
Govt. of West Bengal

Advanced Products Developed in our Laboratory

STUDY OF SINTERABILITY AND PRODUCT DEVELOPMENT BASED ON ZIRCONIA POWDERS TO BE SUPPLIED BY IREL

Project Sanction : IRELTDC/SAO/17/1664A dated 30/04/2019
Name of the PI : Dr. BK. Sanful
Name of the Institute : Govt. College of Engg. and Ceramic Technology, Kolkata

Fully and partially stabilized zirconia are two very important advanced ceramic materials extensively used in many different technologies of recent origin. They possess several interesting properties such as high temperature resistance (refractoriness), chemical inertness even at high temperature, very high hardness and abrasion resistance together with high fracture toughness (highest among the monolithic ceramics), oxygen ion conductivity leading to applications in electrochemical sensors and fuel cells for green energy generation. CaO, MgO, Y_2O_3 and CeO_2 are normally used as additives to develop the properties mentioned above. Preparation of powders with desirable properties and sinterablity at relatively low temperatures are highly challenging tasks. Most zirconia powders currently used in this country either in industry or in research laboratories are imported from overseas.

To overcome this problem, Indian Rare Earth (India) Limited, in short IREL(India) Limited has recently developed a process of zirconia powder preparation followed by establishment of a pilot plant to prepare the powders in a relatively large scale and make them available to the Indian industries and researchers. This is a part of their commitment to **"Make in India"** or **"AtmanIrbhar Bharat"** program of the Govt. of India. However, before making the powders user-ready, it is necessary to demonstrate their properties, such as sinterabilty together with their processing parameters.

The current research project entitled as above has been taken up to evaluate these properties of the powders prepared by IREL(India). Following four different powders were supplied by the company: (1) 3.5 mole % yttria stabilized zirconia (Coded as 3.5YSZ-NSD), (2) 8 mole% yttria stabilized zirconia (Coded as 8YSZ-NSD), (3) 9 mole % magnesia stabilized zirconia (Coded as 9MSZ-NSD) and (4) 12 mole% ceria stabilized zirconia (Coded as 12CSZ-NSD)

These four powders have been thoroughly characterized in terms of particle size and its distribution, specific surface by BET and sintering behavior of these powders by dilatometer. The sintered compacts have been thoroughly characterized in terms of linear shrinkage, apparent porosity, bulk density, micro-hardness, phase analysis by XRD and microstructural analysis by electron microscope.

Some of the important results are given in Figures 1-6 and some photographs of components made by IREL powders are also given in Figures 7-10.

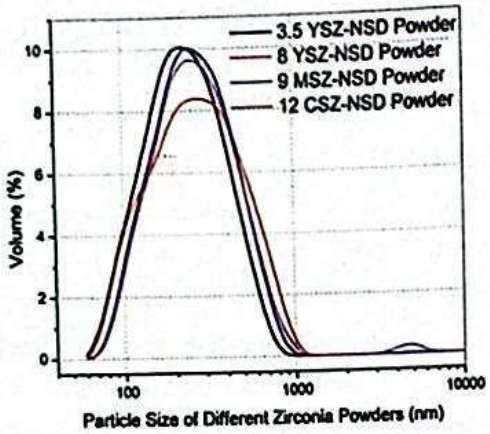

Fig.1: Particle size distribution of 3.5YSZ-NSD, 8YSZ-NSD, 9MSZ-NSD & 12CSZ-NSD powders after attrition milling at the investigator's laboratory.

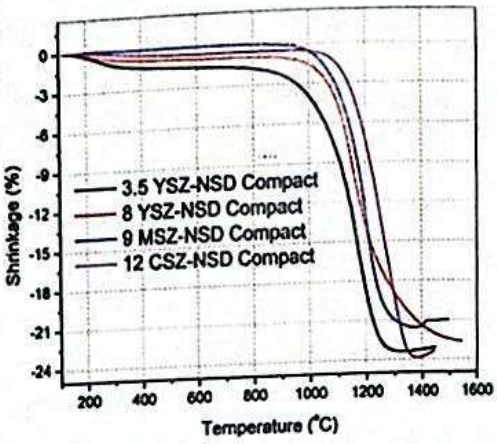

Fig.2: Sintering study of 3.5YSZ-NSD, 8YSZ-NSD, 9MSZ-NSD & 12CSZ-NSD compacts by Dilatometer.

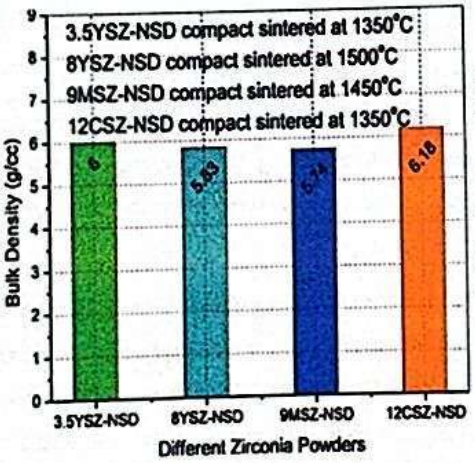

Fig.3: Bulk density of 3.5YSZ-NSD, 8YSZ-NSD, 9MSZ-NSD & 12CSZ-NSD sintered compacts.

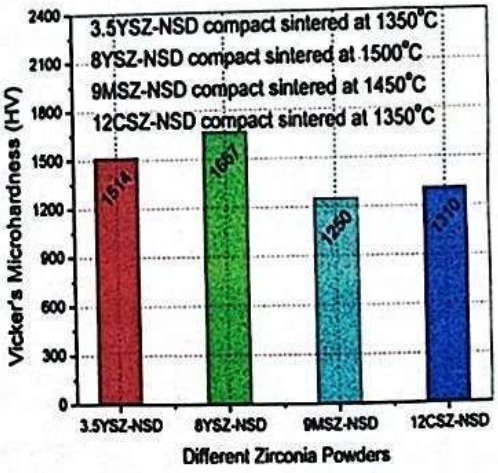

Fig.4: Micro-hardness values of 3.5YSZ-NSD, 8YSZ-NSD, 9MSZ-NSD & 12CSZ-NSD sintered compacts.

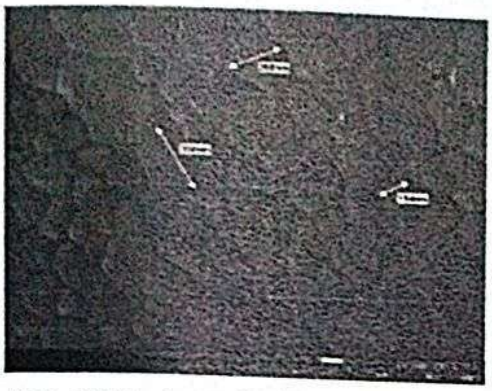

Fig.5: FESEM micrograph of thermally etched polished surface of attrition milled zirconia (3.5YSZ-NSD) compacts sintered at 1350°C.

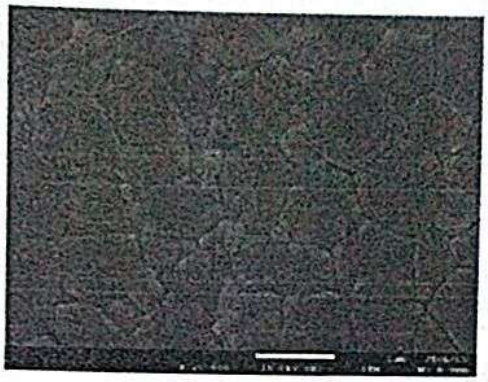

Fig.6: FESEM micrograph of thermally etched polished surface of attrition milled 12CSZ- NSD compacts sintered at 1350°C.

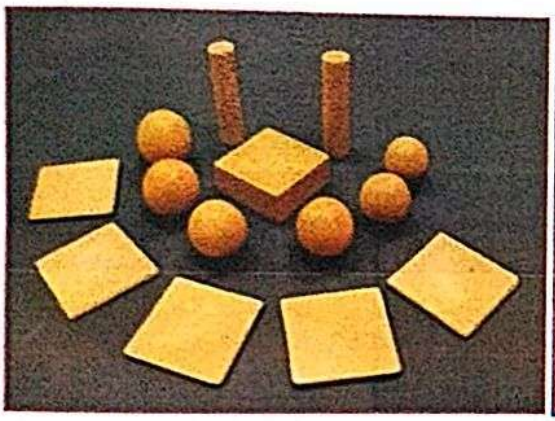

Fig.7: Photographs of the laboratory made different component using IREL made 12 mole % CeO_2 stabilized zirconia powders.

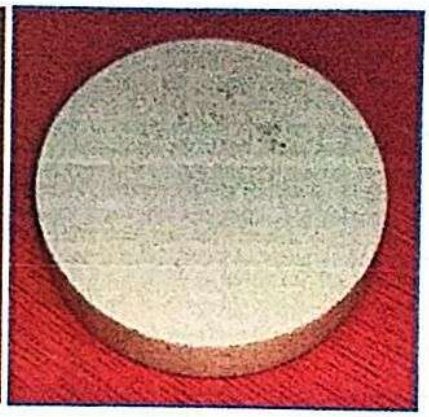

Fig.8: Photograph of the laboratory made disk component using IREL made 3.5 mole % Y_2O_3 stabilized zirconia powders.

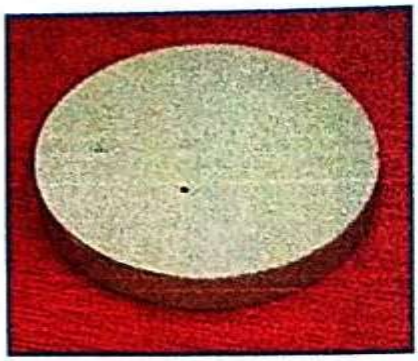

Fig.9: Photograph of the laboratory made disk component using IREL made 8 mole % Y_2O_3 stabilized zirconia powders.

Fig.10: Photographs of the laboratory made different component using IREL made 9mole % MgO stabilized zirconia powders.

Concluding remarks: The average particle size of the IREL (India) made powders is in the range of 240-300nm after attrition milling. The sintering temperature of the IREL(India) made zirconia powders is relatively low. In all cases, the sintered density of the powders has been achieved close to the theoretical densities at relatively low temperature with well-developed microstructure. The micro-hardness values are acceptable. Therefore, the zirconia powders prepared by IREL(India) Ltd. are perfectly suitable for manufacturing of sintered products of different types. They may be used for research purposes as well.

Technology Readiness Level for zirconia powder by IREL(India): 8-9

N.B: The current project is taken up to evaluate the powders developed by IREL(India) and is not a technology development project.

Publicity of our Laboratory Developed Products in Different Media

(a) https://ddnews.gov.in/national/industrially-important-ceramic-products-bottom-ash-thermal-plants-may-reduce-waste-worries

(b) https://www.thehindubusinessline.com/specials/ceramics-from-ash/article33372248.ece

(c) https://dst.gov.in/industrially-important-ceramic-products-bottom-ash-thermal-plants-may-reduce-waste-worries