

Application News

No. X270

X-Ray Analysis

Ceramic Analysis by EDXRF

Ceramics are used in a wide range of fields. Their production process depends on raw materials, intermediate and final products. Manufacturer analyzes the chemical composition of their materials and products on each process for quality control.

Component of these materials are almost inorganics, such as mineral and oxides, which can be analyzed by chemical or wet methods like gravimetric method, ICP-AES, ICP-MS, and AAS.

Also, these analyses can be substituted by EDXRF; Energy Dispersive X-ray fluorescence analysis.

S. Arote, H. Nakamura

The Feature of EDXRF

1. To compete in global market, it is essential to check quality of raw materials and final product in ceramic industries.
2. Range of detected elements by EDX-7000: Na to U & EDX-8100: C to U
3. Automation in quality control without skilled manpower.
4. Conventional methods of chemical analysis are time consuming with Human error.
5. Standardless method allows analysis of raw material such as SiO₂, ZrO₂, Al powder, etc.
6. Analysis of ceramic powder with FP method.
7. Samples are analyzed in pellet form.

Samples

1. Ceramic Powder : Final Product
2. Clay
3. Lime Powder
4. Na₂SO₄ Powder
5. ZrO₂ Powder
6. SiO₂ Powder
7. ZnO Powder
8. NaCl Powder
9. Al₂O₃ Powder
10. TiO₂ Powder

Elements, Oxides

1. Ceramic Powder : Final Product
Na₂O, MgO, Al₂O₃, SiO₂, P₂O₅, SO₃, K₂O, CaO, TiO₂, MnO, Fe₂O₃, CuO, ZnO, SrO, ZrO₂
2. Raw Materials, Intermediate products
Na- U

Flow of Sample Analysis by EDXRF

Following a production process of ceramic powder, the flow of sample analysis and its quantitative results are shown in Fig. 1.

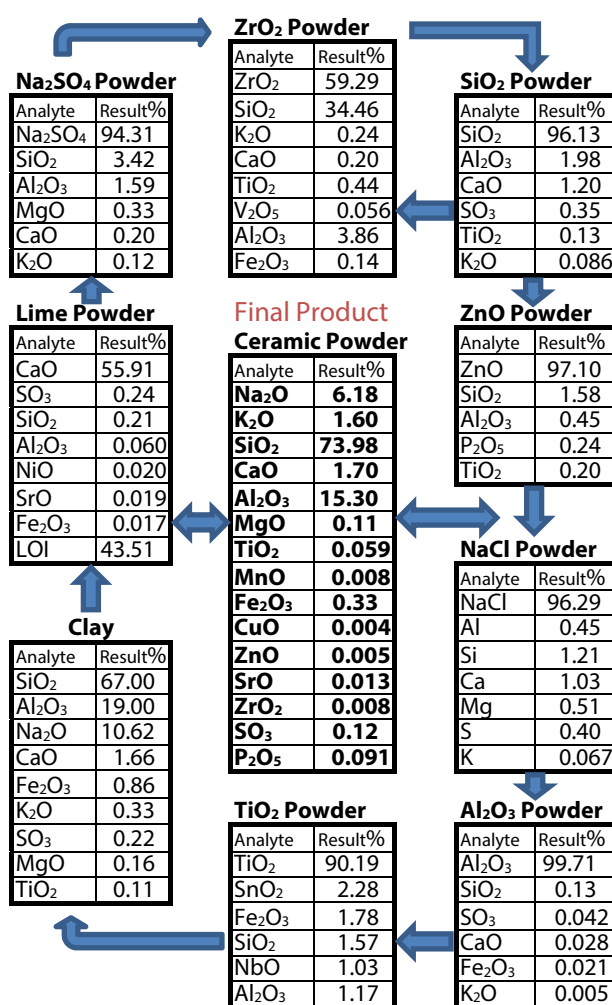


Fig. 1 Flow and results of sample analysis by EDX-7000

Sample Preparation and Setting

1. Briquette Press method : Fig. 2 (a)
 - Boric acid powder is used as a binder.
 - Sample to be measured has been spiked with boric acid powder and pressed by Briquette Press Machine.
2. Powder method : Fig. 2 (b)

Samples that cannot be bonded in pellet form were measured in powder form in a sample cell with polypropylene film.

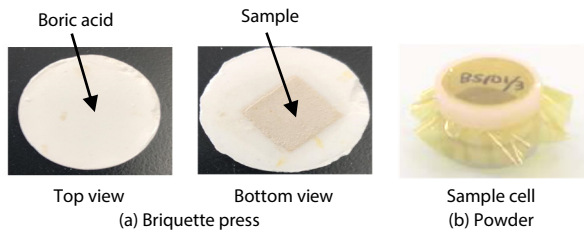


Fig. 2 Sample Preparation

Quantitative Analysis

Ceramic powder as a final product was analyzed by Quantitative FP mode adequated for QC of the composition by specified components.

The spectra for quantitation are shown in Fig. 3.

The raw materials and intermediate products were analyzed by Qualitative-Quantitative mode, which is useful for the unknown sample or detecting unexpected elements. The qualitative profiles of clay and lime powder are shown in Fig. 4.

The quantitative results calculated by FP method were summarized in Fig. 1.

The measurement conditions, except for vacuum, are basically initial settings, for example 50/15 kV-auto, no filters, 10 mmφ, 100 sec. This takes only 3 minutes to get the output.

In conclusion, EDXRF is useful for ceramic analysis as feature shown in this report.

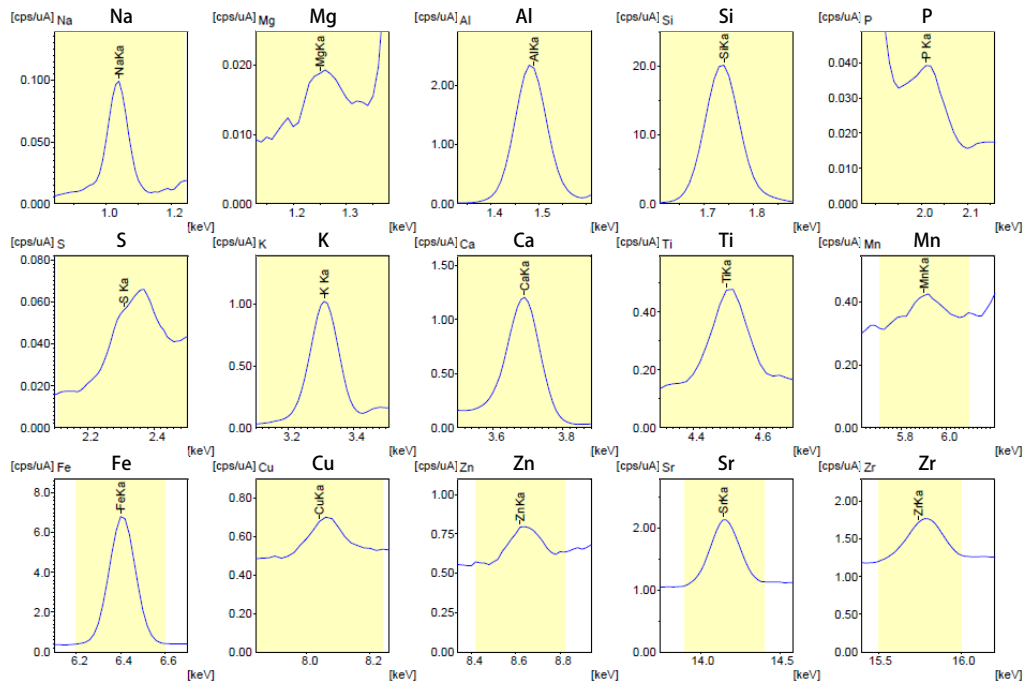


Fig. 3 Spectra for Quantitation

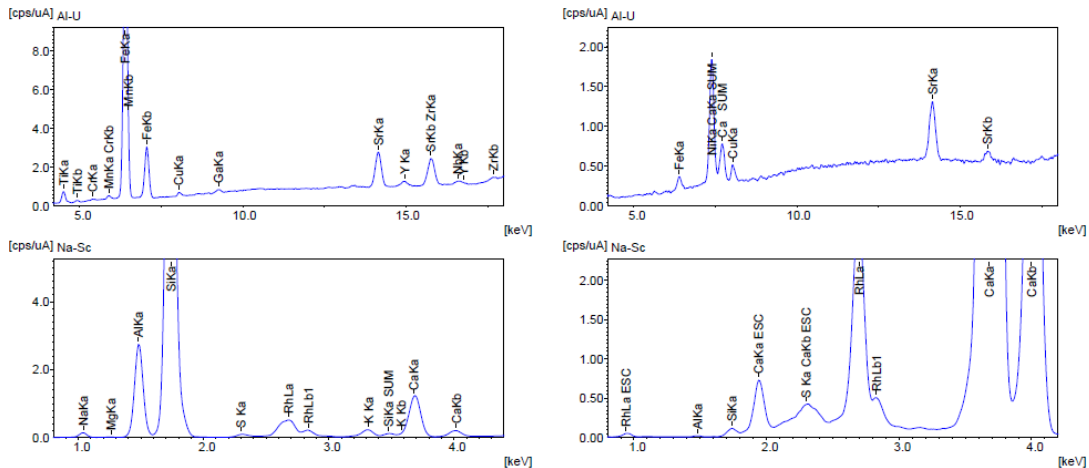


Fig. 4 Na-U Qualitative Results of Clay (Left) and Lime Powder (Right)



Shimadzu Corporation

www.shimadzu.com/an/

For Research Use Only. Not for use in diagnostic procedure.

This publication may contain references to products that are not available in your country. Please contact us to check the availability of these products in your country.

The content of this publication shall not be reproduced, altered or sold for any commercial purpose without the written approval of Shimadzu. Shimadzu disclaims any proprietary interest in trademarks and trade names used in this publication other than its own. See <http://www.shimadzu.com/about/trademarks/index.html> for details.

The information contained herein is provided to you "as is" without warranty of any kind including without limitation warranties as to its accuracy or completeness. Shimadzu does not assume any responsibility or liability for any damage, whether direct or indirect, relating to the use of this publication. This publication is based upon the information available to Shimadzu on or before the date of publication, and subject to change without notice.