Testing and Evaluation of Inorganic Materials I

Edited by
Yiwang Bao, Li Tian and Jianghong Gong

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Testing and Evaluation of Inorganic Materials I

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Preface

The performance of inorganic materials is critical for structural design and engineering application. Testing technique and evaluation methods of material properties, therefore, are the key to the quality and reliability of the inorganic material and components.

The first annual meeting and the launching conference of the Test Technique Branch of Chinese Ceramic Society (CCS-TTB) were held from April 28 to 30, 2010, in Nanchang, Jiangxi Province, China. The main theme of this conference was set on materials properties and testing technique, which covered most aspects of testing techniques on mechanical, chemical, physical properties and micro-structures of ceramics, glass and concrete. The work presented in this event represents the cutting edge development of test techniques in the area of inorganic materials. More than 200 specialists, academics, technicians and students have attended the conference. The secretary-general of Chinese Ceramic Society, Mr. Zhanping Jin and Mr. Fu Tan were present in the meeting and both delivered insightful talks. On behalf of CCS-TTB and academic committee of the conference, I would like to thank their inspiring enthusiasm and positive support to this event.

This is the first symposium of CCS-TTB. It provides a platform for academics, industrialists and students/graduates from various regions of China to exchange ideas and the state-of-the-art development in the field of inorganic materials and testing techniques. This event was also intended to foster the networking and future collaborations between material scientists, testing technologists and instrument manufactories, and has been proved to be overwhelmingly successful. Over 240 manuscripts from participants have been received. These manuscripts cover latest research & development in applications of inorganic material testing and evaluation. Through peer reviewing process, 173 papers were finally accepted and published in this Proceedings. The efforts of the participating authors of all manuscripts are gratefully appreciated.

I would like to express sincere thanks to Dr. Jianghong Gong from Tsinghua University and Dr. Danyu Jiang from Shanghai Ceramic Institute, Chinese Academy of Science, for their tremendous efforts during the course of preparing and organizing the conference. Further thanks are given to Dr Gong for his painstaking editing and reviewing work on the proceedings.

Last but not least, I also thank the members of the organizing committee and technical committee for their time and expertise contributed to CCS-TTB and the successful preparation of this event.

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Foundation of the Standard Curve Database for Quantitative Analysis by Internal Standard Method Based on XRD

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Key words: phase quantitative analysis; internal standard method; standard curve; XRD

Abstract. In order to make quantitative analysis by internal standard method, 24 standard curves of inorganic compounds including quartz, corundum, TiO_2, $BaTiO_3$, etc. were obtained and the corresponding quantitative analyses were accomplished based on the quantitative analysis software attached in Rigaku D/Max-2200 X-Ray diffractometer. Results show that the coefficient of association R of the as-prepared curves are at the range of 0.928－0.980. By validating the samples with due content, it reveals that the analytical results are consistent with the actual values well, which indicate that the prepared standard curves are suitable for high-precision XRD phase quantitative analysis. Uniformity of samples is an important factor in the quantitative analysis by internal standard method.

Introduction

XRD quantitative analysis has been widely used in the research of material science and engineering. The main analysis methods are including internal standard method is an important quantitative analysis [1,2], which must be used with standard working curve. In the present work, the quantitative analysis standard curves of internal standard method for 24 inorganic compounds including quartz, corundum, TiO_2, $BaTiO_3$, etc. were prepared based on the quantitative analysis software attached in Rigaku D/Max-2200 X-Ray diffractometer. The validation and application of these obtained standard curves in quantitative analysis were investigated.

Principle of XRD quantitative analysis by internal standard method

When M grams of the unknown sample is mixed into N grams of internal standard substance, so the mass content for the internal standard substance and J phase of the unknown sample are n/(m+n) and mWJ/(m+n) respectively. I_J and I_s is the diffraction intensity of J phase and internal standard substance S, respectively. So equation can be obtained [1].

$$I_J / I_S = K_{JS} \frac{m}{n} W_J. \quad (1)$$

where, $K_{JS} = K_J / K_S$. If m/n is a constant, equation (2) can be deduced:

$$I_J / I_S = K^1 W_J. \quad (2)$$

In equation (2), K^1 equal $K_{JS}(m/n)$. It suggests that the mass percent of J phase W_J has a linear relation with the ratio of I_J / I_S and is independent of average absorption coefficient. Thus, after testing samples with different proportion standard compositions by XRD and then calculating the intensity ratio of the two diffraction plots, quantitative analysis can be achieved.