

Quantitative analysis of Si by means of ICP-OES

Inductively coupled plasma-optical emission spectrometry (ICP-OES) is widely used for precise inorganic component analysis. The method for decomposition of analytes with chemicals is an important factor affecting analytical results, especially for Si.

Content analysis of Si as an inorganic compound

Silicon is considered to be inorganic compounds in inorganic materials. In this case, the application of alkali fusion for chemical preparation enables high accuracy analysis.

Table1 Si content in Certified Reference Materials (Decomposition by fused alkali) (unit: mass%)

| Sample | Certified value | Analytical result |
|-------------------------------|------------------------------------|------------------------------------|
| Borosilicate glass JCRM R 102 | 80.5 (as SiO ₂) | 80.4 (as SiO ₂) |
| Silicon nitride JCRM R 006 | 59.57 | 59.4 |
| Silicon carbide JCRM R 024 | 68.97 | 69.0 |

Table2 Si content in a Certified Reference Material (Decomposition by hydrofluoric acid)

| Sample | Analytical result |
|-------------------------------|-------------------|
| Borosilicate glass JCRM R 102 | N.D. |



By using hydrofluoric acid in decomposition of analytes, Si will be lost.

The limit of quantitation (LOQ) of this method is 0.00X~0.0X mass% (depends on a sample composition). This method is applicable to inorganic Si compounds in organic material. (The LOQ is 0.0X μg / g ~, depends on a sample composition.)

Content analysis of Si as an organic compound

Organic Si compounds volatilize by heat. Therefore, it is necessary for quantitative analysis of Si standing as an organic Si compounds to be applied special sample preparation.

Our technique was verified using hexamethyldisiloxane and polydimethylsiloxane (PDMS) respectively.

Table3 Si content in organic Si compounds by our method (unit: mass%)

| Sample | Theoretical value of Si (as 100% purity) | Analytical result |
|-----------------------------|--|-------------------|
| Hexamethyldisiloxane (>98%) | 34.6 | 33.5 |
| PDMS | 37.9 | 37.5 |

In the case of organic Si content analysis, without a special care, Si would be lost.

Table4 Si content in organic Si compounds (Same method used in Table1)

| Sample | Analytical result |
|-----------------------------|-------------------|
| Hexamethyldisiloxane (>98%) | N.D. |



The LOQ of this method is around 0.00X mass% (depends on a sample composition).

Table5 Si content in both organic and inorganic Si compounds (unit: mass%)

| Sample | Theoretical value of Si | Analytical result |
|-------------|-------------------------|-------------------|
| Simethicone | 38.4 | 38.8 |

Theoretical value of Si was calculated assuming simethicone consists of SiO₂ (5.8mass%) and PDMS (100% purity).

Quantification of total Si, both inorganic and organic compounds, can be accomplished by applying these techniques.