

Federal Institute for Materials Research and Testing
 in Co-operation with the International Commission on Glass
 -Technical Committee 2-

Certified Reference Material

BAM-S004 Glass Containing Hexavalent Chromium

Please note the safety guidelines (see page 4)

Certified Values

Element	Mass fraction in mg/kg	Uncertainty ³⁾ in mg/kg
Cr-hexavalent ¹⁾	94	± 5
Cr-total ²⁾	471	± 25

¹⁾ Mass fraction of hexavalent chromium in the glass, determined by using only one definite analytical procedure as explained on the next page and described in the attached document.
²⁾ Mass fraction of total chromium in the glass, determined by different analytical methods after total wet digestion or after digestion by fusion of the analysed glass sample.
³⁾ The certified uncertainty is the expanded uncertainty estimated in accordance with the Guide to the Expression of Uncertainty in Measurements (GUM) with a coverage factor $k = 2$.

Sample description

The certified reference material BAM-S004 consists of container glass for cosmetics. It was crushed into pieces < 10 mm in size and contains a powdered fraction. The material is supplied in glass bottles containing 50 g.

Informative values

Not certified, informative values were determined by one of the participating laboratories.

Mass fractions in mass%.

Analyte	SiO ₂	Na ₂ O	CaO	Al ₂ O ₃	BaO	MgO	ZnO	SO ₃	K ₂ O	Cr ₂ O ₃	Fe ₂ O ₃	CuO
Mass fraction	70.9	14.5	9.4	2.15	1.2	0.90	0.33	0.17	0.16	0.07	0.06	0.04

Date of certification: December 2003
 Certificate revised March 2016

Means of the series of measurements for one analytical procedure in one laboratory (Laboratory means)

Mass fractions in mg/kg

Line No.	Cr-(VI)	Cr-total
1	79.2	406
2	82.0	415
3	89.7	417
4	91.7	432
5	93.9	447
6	95.2	467
7	97.4	473
8	98.0	473
9	98.3	475
10	98.3	481
11	98.4	490
12	98.6	500
13	99.1	510
14		518
15		557
<i>M</i> :	94	471
<i>s_M</i> :	7	50
<i>s</i> :	2.3	10

M: Arithmetic mean of the laboratory means

s_M: Standard deviation of the laboratory means

s: Arithmetic mean of the intralaboratory standard deviations

Analytical procedure used for determination of mass fraction of hexavalent chromium

The certified value for the mass fraction of hexavalent chromium is based on laboratory mean values determined by different laboratories using only one analytical procedure (consensus value) attached to this certificate. It is almost identical to the published paper:

E. Guadagnino, P. Sundberg, O. Corumluoglu "A collaborative study on the determination of hexavalent chromium in container glasses", in: Glass Technol. **42** (2001) 148-152.

A minor change has to be made in this published paper concerning the composition of the decomposition mixture, where the volume of the diluted (1+1) sulphuric acid taken must be read as 40 ml (instead of 80 ml) and the resulting pH should be 3 (instead of 2).

Analytical methods used for the determination the of mass fraction of total chromium

List of abbreviations of methods used for final determination after total wet chemical digestion (1) or after digestion by fusion (2)

ET AAS	Atomic absorption spectrometry with electrothermal atomisation (1)
F AAS	Flame atomic absorption spectrometry (1)
ICP OES	Inductively coupled plasma optical emission spectrometry (1)
XRF	X-ray fluorescence spectrometry (2)

Element	Line No.	Analytical method used
Cr-total	6	ET AAS
	1, 8, 12, 14	F AAS
	2, 3, 4, 5, 9, 10, 11, 13, 15	ICP OES
	7	XRF

Participating laboratories (arranged alphabetically)

Bergakademie Freiberg – Institut für Silikattechnik, Freiberg (Germany)
Bormioli Luigi spa, Parma (Italy)
Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany)
Laboratory: Preparation of Proficiency Testing Samples and Reference Materials for Inorganic Soil and Water Analysis
Laboratory: Trace Element Analysis; Spectral Analysis
Corning Europe Inc., Avon (France)
Forschungsinstitut für anorganische Werkstoffe, Höhr-Grenzhausen (Germany)
Glasforskningsinstitutet (GLAFO), Växjö (Sweden)
Glass Institute, Hradec Králové (Czech Republic)
Institut Scientifique du Verre, Charleroi (Belgium)
ISOVER Saint-Gobain, CRIR, Rantigny (France)
Pilkington European Technical Centre, Lathom, Lancashire (Great Britain)
Saint-Gobain Glass Germany, Herzogenrath (Germany)
Schott Glaswerke, Mainz (Germany)
Stazione Sperimentale del Vetro, Murano-Venice (Italy)
Turkiye Şişe ve Cam Fabrikalari A.Ş. Glass Research Center, Istanbul (Turkey)

Recommendations for correct sampling and sample preparation

For each determination, the homogeneity testing of this material was carried out with masses of 1 g of sub-samples, each taken from different sample subsets of 5 g, which had been ground. An increase in uncertainty intervals could result if the amount of sample used for an analytical determination is less than this. To ensure a representative sub-sampling for the analysis, shake the bottle containing the CRM in different directions before taking sample material for sub-sampling; at least 5 g of sample material must be taken from the bottle before grinding (< 200 µm) and thorough mixing has to be performed. Sub-samples of at least 1 g should be taken from this ground material. Close lid of the sample bottle tightly after use.

Recommendations for correct storage

The sample should be stored in a dust-free and dry environment avoiding contamination and contact with moisture.

Expiration of certification

The date of expiry of certification is 30th April 2026. Before this date a new certificate will be prepared with a new date of expiry.

Safety guidelines

1. First aid measures

In case of contamination of the eyes by dust, rinse thoroughly with water with the eyelids held open. If product is swallowed, induce vomiting and consult a physician.

2. Handling

Avoid formation and deposition of dust. Ensure adequate ventilation and, if necessary, exhaust ventilation when handling or transferring the product. To avoid injuries do not bring the material into contact with your skin.

3. Exposure restriction and personal protection

Hand protection: protective gloves

Eye protection: safety goggles

4. Disposal considerations

Unused material: reuse if possible.

Or: may be disposed of in controlled landfills provided local regulations are respected.

References

Guadagnino, E., Sundberg, P., O. Corumluoglu "A collaborative study on the determination of hexavalent chromium in container glasses", in: Glass Technol., 42 (2001) 148-152

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