



## CERTIFICATE OF ANALYSIS

### Brass WR series

The assigned values<sup>1</sup> and uncertainties<sup>2</sup> in % w/w

Element	No.	WR1	WR2	WR3	WR4	WR5
Al		<b>0.496</b> ±0.0076	<b>1.092</b> ±0.011	<b>1.683</b> ±0.025	<b>2.297</b> ±0.043	<b>3.024</b> ±0.059
Ni		<b>3.534</b> ±0.0082	<b>2.683</b> ±0.014	<b>1.799</b> ±0.011	<b>0.989</b> ±0.019	<b>0.251</b> ±0.011
Sn		<b>0.605</b> ±0.019	<b>0.453</b> ±0.0091	<b>0.254</b> ±0.0075	<b>0.100</b> ±0.0048	<b>0.0116</b> ±0.00079
Mn		<b>1.051</b> ±0.026	<b>1.631</b> ±0.0027	<b>1.674</b> ±0.035	<b>2.254</b> ±0.048	<b>3.070</b> ±0.084
Fe		<b>0.0577</b> ±0.0021	<b>0.802</b> ±0.0033	<b>0.184</b> ±0.011	<b>0.600</b> ±0.0073	<b>0.141</b> ±0.014
Pb		<b>0.0496</b> ±0.0030	<b>0.291</b> ±0.0083	<b>0.514</b> ±0.011	<b>0.683</b> ±0.020	<b>0.885</b> ±0.023
Cd		<b>0.00045</b> ±0.00025	<b>0.00548</b> ±0.00008	<b>0.00807</b> ±0.00016	<b>0.0154</b> ±0.00057	<b>0.0200</b> ±0.00072
Co		<b>0.00196</b> ±0.00020	<b>0.00210</b> ±0.00008	<b>0.0106</b> ±0.00095	<b>0.0154</b> ±0.00090	<b>0.0196</b> ±0.0013
Cr		<b>0.00049</b> ±0.00009	<b>0.00705</b> ±0.00035	<b>0.0149</b> ±0.00045	<b>0.0190</b> ±0.0013	<b>0.0253</b> ±0.0030
Sb		<b>0.00046</b> ±0.00017	<b>0.00566</b> ±0.00042	<b>0.0150</b> ±0.0024	<b>0.0247</b> ±0.0027	<b>0.0334</b> ±0.0018
Bi		<b>0.00109</b> ±0.00012	<b>0.00642</b> ±0.00027	<b>0.0118</b> ±0.0017	<b>0.0211</b> ±0.00095	<b>0.0278</b> ±0.0019
As		<b>0.203</b> ±0.0062	<b>0.0129</b> ±0.0015	<b>0.0492</b> ±0.0021	<b>0.00528</b> ±0.00081	<b>0.00129</b> ±0.00057
P		<b>0.00122</b> ±0.00021	<b>0.0311</b> ±0.0038	<b>0.0126</b> ±0.0013	<b>0.0213</b> ±0.0023	<b>0.0282</b> ±0.0003
Si		<b>1.097</b> ±0.052	<b>0.817</b> ±0.037	<b>0.566</b> ±0.031	<b>0.279</b> ±0.021	<b>0.0485</b> ±0.0067
Cu		<b>55.72</b> ±0.13	<b>56.99</b> ±0.098	<b>58.95</b> ±0.048	<b>60.07</b> ±0.24	<b>61.20</b> ±0.12
Zn		remain	remain	remain	remain	remain

<sup>1</sup> Unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method of determination.

<sup>2</sup> The certified uncertainty is the expanded uncertainty with a coverage factor k=2, corresponding to a level of confidence of about 95 %.

Prof. Zbigniew Śmieszek  
Director of the Institute

Certified on November 2014



Description of the material:

The certified reference materials are available in the form of discs (40 mm diameter and ~25 height).

Analytical methods applied:

- Al, Ni, Sn, Mn, Fe, Pb, Cd, Co, Cr, Sb, Bi, As – Inductively coupled plasma optical emission spectrometry (ICP OES),  
Flame atomic absorption spectrometry (FAAS),
- P – Inductively coupled plasma optical emission spectrometry (ICP OES)  
Spectrophotometric method
- Si – Spectrophotometric method  
Gravimetric method
- Cu – Electrogravimetric method

Participants:

Institute of Non-Ferrous Metals, Analytical Chemistry Department, Gliwice, Poland

- Optical Emission Spectrometry Laboratory
- Atomic Absorption Spectrometry Laboratory
- Classical Analytical Methods Laboratory

Walcowania Metali „Dziedzice” S.A., Czechowice – Dziedzice, Poland

Walcownia Metali Nieżelaznych „Łabędy” S.A., Gliwice, Poland

Universal Scientific Laboratory Pty Ltd, Milperra, Australia

Exova Ltd, Middlesbrough, England

Intended use:

The CRM is intended for establishing or checking the calibration of optical emission and X-ray spectrometers for analysis of samples of similar matrix composition (for micro-analysis is not verified).

Instructions for use:

Before every use, the surface of CRM must be prepared by milling or turning on a lathe. Samples should be prepared in the same way as the CRM.

Brief description of the production and certification process:

The CRM<sub>s</sub> – WR were made by melting of all components in the inductive, of crucible furnace and by casting into special moulds protecting elimination of segregation of the components during solidification. Homogeneity testing were made taking into account over 50% of the material produced. Investigations were carried out using atomic emission spectrometry method with low voltage spark. Homogeneity was estimated statistically with application of the test F.

The set consists of 5 certified reference materials in form of discs 40 mm in diameter and ~25 mm height.

The certification of WR series is valid indefinitely, within the measurement uncertainties specified, provided the CRM is handled in accordance with the instructions given in this certificate.