IRMM

Institute for Reference Materials and Measurements

CERTIFICATE
ISOTOPIC REFERENCE MATERIAL (SPIKE) IRMM-618

$(1.121\ 3 \pm 0.001\ 7) \cdot 10^{-4}$ mol $^{87}Rb \cdot kg^{-1}$ of solution

The Isotopic Reference Material (Spike) is supplied with a molar concentration of ^{87}Rb certified as above.

Other rubidium isotopes present are related to the ^{87}Rb concentration through the following certified molar ratio :

$n(^{85}Rb)/n(^{87}Rb)$	:0.020 498	±0.000 024

This corresponds to an isotopic composition with following abundances :

	Amount %	Mass %	Uncertainty
^{85}Rb	2.008 7	1.963 4	±0.002 3
^{87}Rb	97.991 3	98.036 6	±0.002 3

The molar mass of the rubidium is (86.869 066 ± 0.000 045) g·mol^{-1}

From the certified values, the following element concentrations are derived :

(9.743	±0.015	) ·	10^{-6} kg	^{87}Rb	· kg^{-1} of solution
(9.940	±0.015	) ·	10^{-6} kg	Rb	· kg^{-1} of solution
(1.144 3	±0.001 7	) ·	10^{-4} mol	Rb	· kg^{-1} of solution

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NOTES

1. All uncertainties indicated are levels of possible inaccuracies, computed on a 2s basis for all components. These include : measurement reproducibility, reproducibilities of measurements of correction factors for known systematic errors and possible uncertainties of systematic nature estimated on a 2s equivalence basis.

2. IRMM-618 consists of flame-sealed quartz glass ampoules containing about 5 ml of a chemically stable solution of rubidium in nitric acid. The molality is about 0.5 m HNO_3 (i.e. 0.5 mol $HNO_3 \cdot kg^{-1}$ of solvent); the molarity is about 0.5 M HNO_3 (i.e. 0.5 mol $HNO_3 \cdot L^{-1}$ of solution).

3. The Avogadro constant used is $(6.022\ 136 \pm 0.000\ 012) \cdot 10^{23}\ mol^{-1}$.

4. The molar masses, used in the calculations, are

   ^{85}Rb : (84.914 390 ± 0.000 008) $g \cdot mol^{-1}$
   ^{87}Rb : (86.911 794 ± 0.000 006) $g \cdot mol^{-1}$

5. Using this Spike Reference Material (Spike), ^{85}Rb and Rb concentrations in unknown samples can be determined by Isotope Dilution Mass Spectrometry, through a measurement of the molar isotope dilution ratio R_B = ***n***(^{85}Rb)/***n***(^{87}Rb) in the blend. They should be computed with the aid of the following formula which allows an easy identification of the sources of the uncertainties in the procedure :

$$c\left(^{85}Rb\right)_X = \frac{R_Y - R_B}{R_B - R_X} \cdot R_X \cdot \frac{m_Y}{m_X} \cdot c\left(^{87}Rb\right)_Y$$

$$c(Rb)_X = \frac{R_Y - R_B}{R_B - R_X} \cdot \frac{1 + R_X}{1 + R_Y} \cdot \frac{m_Y}{m_X} \cdot c(Rb)_Y$$

where

R_X	=	molar ratio ***n***(^{85}Rb)/***n***(^{87}Rb) in the unknown sample material
R_Y	=	molar abundance ratio ***n***(^{85}Rb)/***n***(^{87}Rb) in the spike material
m_X	=	mass of the unknown sample
m_Y	=	mass of the sample of spike solution used
$c\left(^{85}Rb\right)_Y$	=	number of moles $^{85}Rb \cdot kg^{-1}$ sample material
$c\left(^{87}Rb\right)_X$	=	number of moles $^{87}Rb \cdot kg^{-1}$ spike solution
$c(Rb)_X$	=	number of moles $Rb \cdot kg^{-1}$ sample material
$c(Rb)_Y$	=	number of moles $Rb \cdot kg^{-1}$ spike solution.

6. This Isotopic Reference Material (Spike) is traceable to the international SI unit for amount of substance - the mole - in the shortest possible way. Measurements calibrated against these Isotopic Reference Materials will, therefore, also be traceable to the SI unit system.

The isotopic measurements by Thermal Ionisation Mass Spectrometry were performed by G. Lapitajs.

Chemical preparation of the samples for isotopic measurements was performed by G. Lapitajs and A. Verbruggen.

The purity of ^{87}Rb was determined by Spark Source Mass Spectrometry by W. Lycke.

Metrological aspects involved in the preparation and certification were performed by F. Hendrickx. The ampoulation of this Isotopic Reference Material (Spike) was accomplished by G. Lapitajs, A. Alonso-Muñoz and A. Verbruggen.

The overall co-ordination leading to the establishment, certification and issuance of this Isotopic Reference Material (Spike), was performed by A. Verbruggen.

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