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High Resolution Mixing Calorimetry (HRMC) redivivus.
3. Calibration

MOTTO: ***Material science without calorimetry is blind.***

Previous results presented on HRMC experiments are obtained at room temperature and the same sensitivity of measuring ac-bridge [1, 2]. Parameters heat flow (w(t)), hp, E and E1 defined on thermograms are expressed in Volt, but taking into account that have different physical meanings. The aim of the present note is to establish the SI units of each such quantity by calibration. The special calorimetric cell with a heating element is used for this purpose and the power supply generating heat pulses controlled in power, Ph(W) and time, tp (Figure 5 and 6, [1]). The same power supply was used for heat capacity measurements [1].

All calibration experiments presented in this note were performed at the same sensitivity of the ac-bridge as in previous HRMC measurements.

Figures 1-3 shows series of thermograms (exothermals) obtained for three different Ph values. It can observe the different shapes as depending on both tp and Ph. Figures 4-9 show the dependences of the main parameters defined initially on typical HRMC thermogram [1] as function of E in Joule as resulted from the calibration straight line in Figure 5 gathering values obtained in all calibration experiments. For each series of data the best fit functions are established by linear or non-linear regressions. These fits can be compared with the similar parameters resulted in other kinds of experiments [1, 2]. It is important to note that all these series of dependences are convergent to the same value for E(J) = 0.

It is also important to consider again the previous results obtained for heat capacity on 1 mL specimens (heat pulse experiments at the same Ph and tp=120 s [1]) and mixing energy Em (J) reported to mass of specimens obtained by mixing experiments on aqueous solutions by using absolute ethanol as structure developer [2]. Parameter hp as expressed in ^{0}C is obtained by considering water as standard; hp is also calibrated in unit of heat flow (J/s) according to the general purely dissipative law: TS-TR = Rh*w (Rh = 36.07 ^{0}C*s/J = thermal resistance between sample and reference cells). Table 1 presents these data and Figure 10 shows the dependences of Em/m (J/g) on the specific heat, Cp(J/(g*^{0}C)). It results different phylogenies defined by linear dependences gathering the same nature of structures, namely glycerol solutions with more stable structures than solutions of ionic salts, but increasing with glycerol content. In the series of ionic salts Na2CO3anh-sat and water are not included and the increasing structure stability is in the following order:

MgSO4.7H2O-sat > CuSO4anh-sat > Na2SO4anh-sat (1).

Conclusions:

(i) Calibration of HRMC quantities is necessary in view to make the right differences between nature and amplitude of revealed processes associated to mixing experiments.

(ii) Mixing experiments on the same samples under test but by using different developers allow to evidence more accurately the nature and amplitude of their composite structure by establishing higher phylogenies.

(iii) Heat capacity and specific heat appears important structural parameters obtained in accurate and rapid manner by HRMC technique revealing also the composite structure of tested samples completing structural data obtained by mixing experiments and other analytical techniques.

(iv) Calorimetry, especially HRMC, must be promoted in material science research and technology as providing in highly efficient manner (accurate, rapid, easy to operate and low cost) structural information not available from much more sophisticated, expensive and difficult to operate analytical techniques.

References

[1] G. Dragan, HRMC redivivus.1. General presentation and heat capacity measurements, GDF Databanks Bull., 19(1) 2015.

[2] G. Dragan, HRMC redivivus. 2. Structure developing of aqueous solutions by mixing experiments, Databanks Bull., 19(2) 2015.

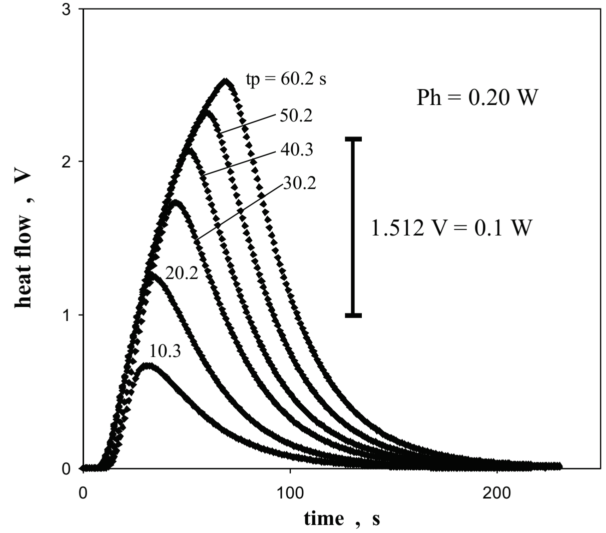


Figure 1.

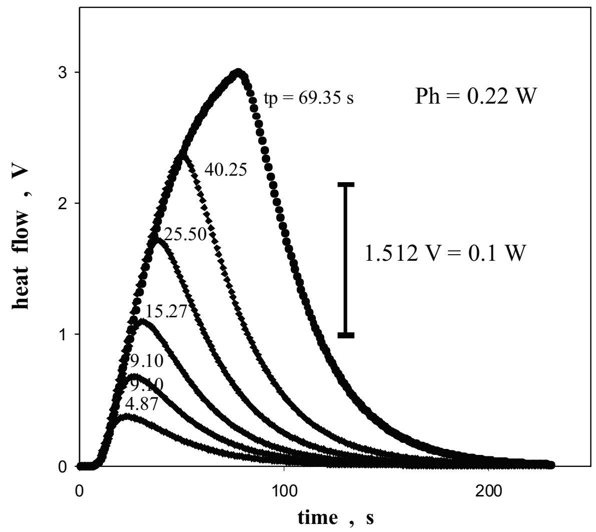
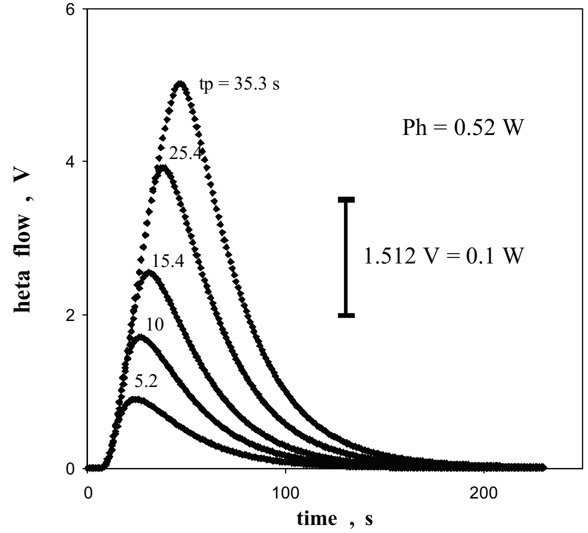


Figure 2.



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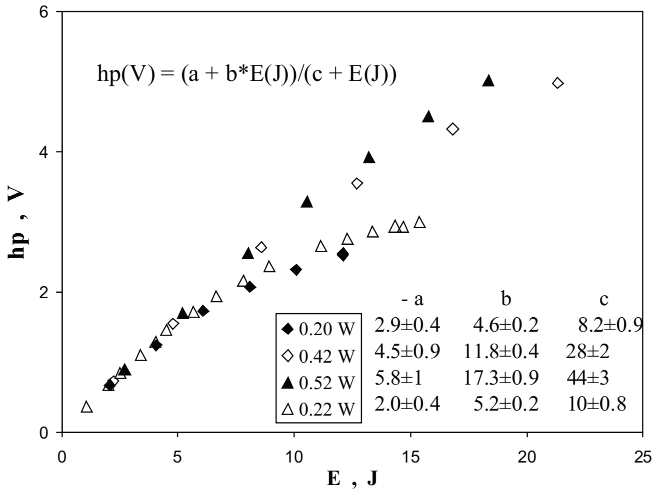

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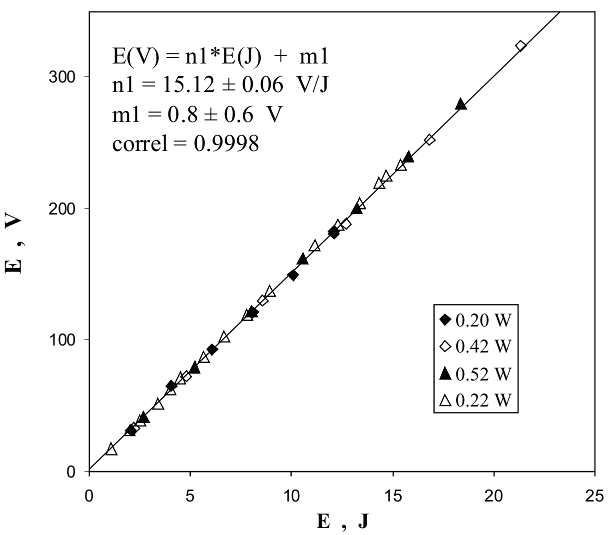

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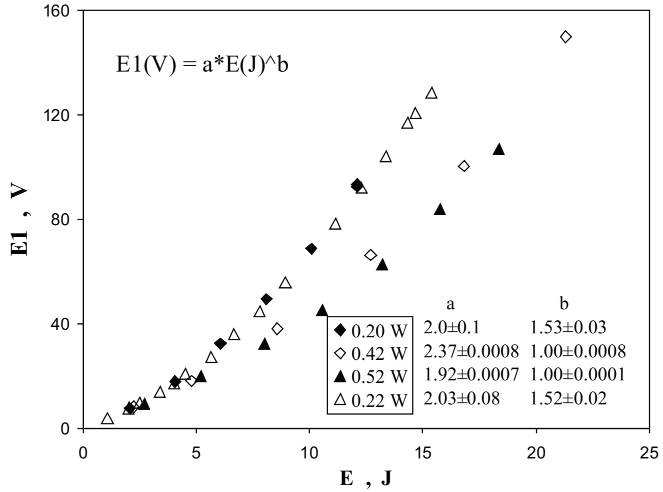

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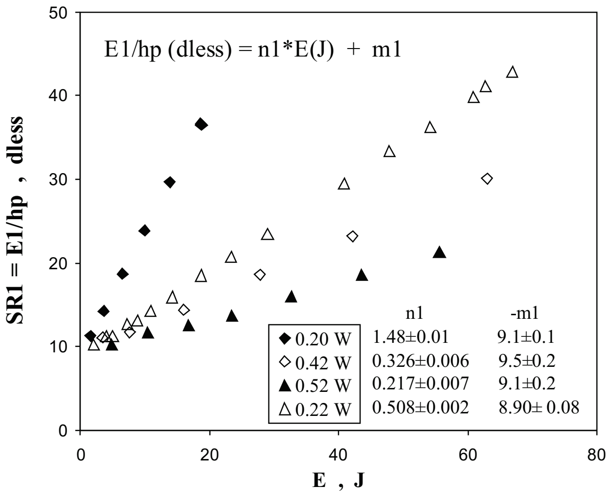

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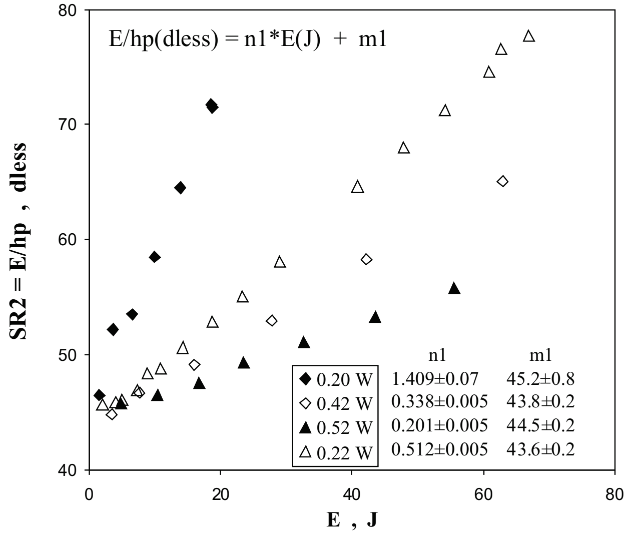

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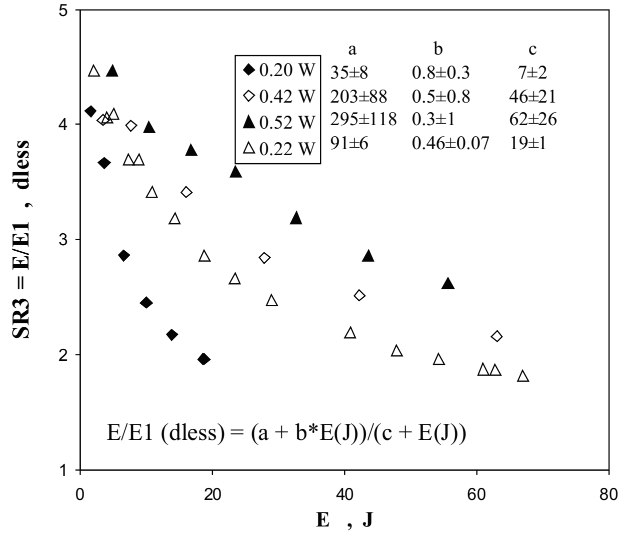

Figure 9.

Table 1.Comparative results obtained by heat pulse and mixing experiments after calibration of temperature and energy.

	m , g/mL	heat pulse experiment, 1 mL, tp=120 s			mixing exp.*
		hp ,oC	E/m , J/g	Cp , J/(g*oC)	Em/m , J/g
water	0.9995	3.68	15.45	4.18	35.41
CuSO4anh-sat	1.1722	3.94	13.68	3.47	35.83
Na2CO3anh-sat	1.1208	3.67	13.69	3.73	22.13
Na2SO4anh-sat	1.0889	3.77	13.93	3.69	71.36
MgSO4.7H2O-sat	1.2667	3.54	11.83	3.34	14.15
Glycerol 40%vol	1.1222	3.68	13.86	3.77	4.20
Glycerol 50%vol	1.1515	3.20	11.73	3.67	2.62
Glycerol 60%vol	1.1889	2.99	10.64	3.56	-1.31

all experiments at room temperature (23 ± 2 ºC); * 0.5 mL soln. + 0.1 mL EtOH

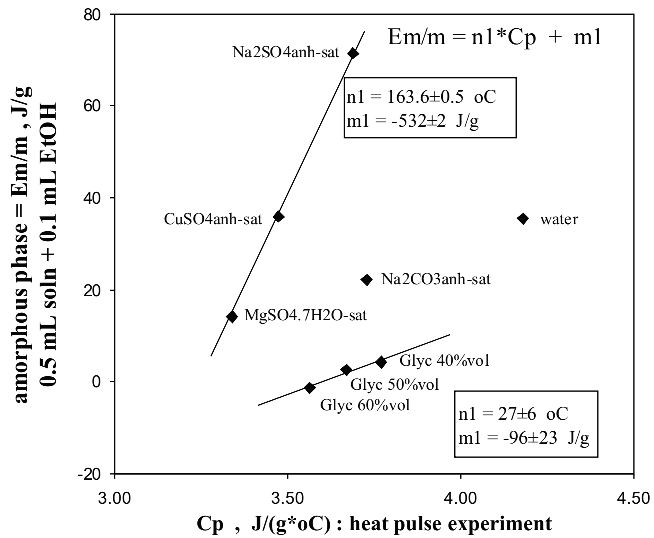

Figure 10.

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publications	● >100 scientific papers ● >70 scientific communications ● 17 patents ● 5 books
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Previous issues of GDF DATABANKS BULLETIN

Year	VOL	NO	Content (titles)	$*)
1997	1	1	Editorial: Databanks – the compulsory language. LOGKOW – a Databank of evaluated octanol-water partition coefficients (James Sangster). Solubility behavior introducing topoenergetic working principles. Comments on 1-octanol-water partition of several n-alkane related series.	F
1997	1	2	Guide of good practice in metrology (Romanian)	AFI
1998	2	1	Editorial: socio-psychological implications in creation and utilization of a databank (Ioan-Bradu Iamandescu); Behavior in vapor-liquid equilibria (VLE): I. Structural aspects; Behavior in vapor-liquid equilibria: II. Several structures in databanks; Symposium on VDC-4 held on 30 October 1997 at Lubrifin-SA, Brasov (Romania).	F
1998	2	2	Practical course of metrology (Romanian)	AFI
1998	2	3	DIFFUTOR-01: Thermally driven diffusion in pure metals	AFI
1998	2	4	VAPORSAT-01: Databanks of thermally driven VLE. The first 100 simple molecules	AFI
1999	3	1	Editorial: New trends in material science: nanostructures (Dan Donescu) DIFFUTOR: Databanks of diffusion kinetics. VAPORSAT: Databanks of vapor-liquid separation kinetics.	F
1999	3	2	Discussions on Applied Metrology	AFI
2000	4	1	Editorial: Laboratory accreditation and inter-laboratory comparisons (Virgil Badescu) Doctoral Theses – important data banks. GDF intends to open new series of experiments on thermo-physical properties. Some comments on uncertainty: global budget and DFT analysis. Events: The 9th International Metrology Congress, Bordeaux, France, 18-21 October 1999.	F
2000	4	2	Measurement and Calibration.	AFI
2001	5	1	Editorial: Metrology ensures moral and technological progress. Topoenergetic aspects of amorphous-crystalline coupling. I. Composite behavior of water and aqueous solutions (paper presented at nanotubes and Nanostructures 2001, LNF, Frascati, Rome Italy, 17-27 October 2001). Events: Nanotubes and nanostructures 2000.School and workshop, 24 September – 4 October 2000, Cagliari, Italy.	F
2001	5	2	Editorial: Viscosity – a symptomatic problem of actual metrology. Visco-Dens Calorimeter: general features on density and viscosity measurements. New vision on the calibration of thermometers: ISOCALT® MOSATOR: Topoenergetic databanks on molten salts properties driven by temperature and composition.	F

2002	6	1	MOSATOR-01: Topoenergetic databanks for one component molten salts; thermally driven viscosity and electrical conductance.	AFI
2002	6	2	Editorial: HuPoTest - Operator calibration or temporal scale psychic test. MOSATOR: topoenergetic databanks of one component molten salts; thermally driven viscosity and electrical conductance.	F
2002	6	3	Editorial: Quo vadis Earth experiment? ISOCALT® : Report on metrological tests	F
2003	7	1	Editorial: Time – an instrument of the selfish thinking. 1st NOTE: Homoeopathy: upon some efficient physical tests revealing structural modifications of water and aqueous solutions. I. Mixing experiments.	F
2004	8	1	Metrological verification and calibration of thermometers using thermostats type ISOCALT® 21/70/2. Metrological verification and calibration of thermometers using thermostats type ISOCALT® 2.2R.	F
2004	8	2	Aspects of correct measurements of temperature. I. measurement of a fixed point according to ITS-90. Physics and Homoeopathy: some physical requirements for homoeopathic practice.(Plenary lecture at the 19th SRH National Congress, 21-22 September 2004, Bucharest, Romania)	F
2005	9	1	AWARD for ISOCALT® at the International Fair TIB-2004, October 2004, Bucharest. ISOCALT® 3/70/21 was awarded in a selection of 20 products by a commission of experts from the Polytechnic University of Bucharest. Upon some aspects of temperature measurements. (12th International Metrology Congress, 20-23 June 2005, Lyon, France)	F
2005	9	2	A new technique for temperature measurement and calibration. National Society of Measurements (NSM). Important warning for T-calibrator users: MSA has chose metrology well calibrators from Fluke (Hart Scientific).	F
2005	9	3	Universal representation of Cancer Diseases. 1. First sight on NSW-2003 report. Universal representation of Cancer Diseases. 2. UK cancer registrations on 1999-2002. Vital Potential can estimate our predisposition for cancer diseases.	F
2006	10	1	NTC – thermistors -1	AFI
2007	11	1	HuPoTest - 40 years of continuous research Basic rules for preventing and vanishing cancer diseases Climate change = change of mentality Hot nuclear fusion – a project of actual mentality	F
2007	11	2	MT – Introduction to Mental Technology HuPoTest – general procedure, assignments of results, specimen of complete test, order and obtain your complete HuPoTest report	F
2007	11	3	TRESISTOR© - data banks of materials with thermally driven electric and magnetic properties TRESISTOR© - NTC -1 - data bank of NTC thermistors	AFI

2008	12	1	Australian population: life, death and cancer	F
2008	12	2	Pattern of Cancer Diseases	F
2008	12	3	Adiabatic calorimetry – summary description of the demo prototype	F
2008	12	4	Flight QF 30 and even more… Temperature calibration of NTC-thermistors. 1.Preliminary results.	F
2009	13	1	Proposal for interlaboratory comparisons. Calibration of NTC-thermistors (The 14th International Metrology Congress, Paris, France, 22-25 June 2009).	F
2009	13	2	Sudoku – un algoritm de rezolvare. (Sudoku – an algorithm for solution).	AFI
2009	13	3	Cancer and Diabetes – as social diseases. (Open letter to all whom it may concern).	F
2010	14	1	Studies on cement hydration by High Resolution Mixing Calorimetry (HRMC).	F
2010	14	2	Measuring tools for subtle potentials; pas-LED: an efficient measuring tool for subtle potentials.	F
2010	14	3	Upon some features of cancer in Australia: 1982 – 2006.	F
2010	14	4	Cancer as an erosion process in human society.	F
2010	14	5	Cancer erosion in Australian human society: 1982 – 2006.	F
2010	14	6	Cancer erosion in German human society:1980-2008.	F
2011	15	1	Procedures and devices for energy and water saving. (I) (in Romanian).	F
2011	15	2	Structural and relativistic aspects in transforming systems. I. Arrhenius and Universal representations of thermally driven processes.	F
2011	15	3	Topoenergetic aspects of water structuring as revealed by ac electric conductivity.	F
2011	15	4	Topoenergetic aspects of human body	F
2011	15	5	HuPoTest: four month study of a case	F
2012	16	1	DTA study of water freezing. I. Upon some aspects of repeatability.	F
2012	16	2	DTA study of water freezing. II. Statistical features on one week of experiments.	F
2012	16	3	DTA study of water freezing. III. New facts on daily mental field.	F
2012	16	4	Mental field and state of health. Câmpul mental și starea de sănătate.	F
2013	17	1	DTA study of water freezing. IV. New facts on energy circuits.	F
2013	17	2	DTA study of water freezing. V. Effect of a mental antenna	F
2013	17	3	AC electric conductivity of untreated and mentally treated electrolyte aqueous solutions.	F
2013	17	4	DTA study of water freezing. VI. Mental field in a working day.	F
2013	17	5	DTA study of water freezing. VII. More statistical features on one week of experiments.	F
2013	17	6	HuPoTest: New measurements and results	F

2013	17	7	Time as unique base quantity. (Proceedings of the 16th International Congress of Metrology, 7-10 October 2013, Paris, France).	F
2013	17	8	Eurovision song contest. 1.Basic social aspects	F
2013	17	9	Mental field-water interaction as evidenced by Isothermal Convection Flow Calorimetry (ICFC). I. ICFC description and preliminary results.	F
2013	17	10	1. Procedure for defining standard liquids for viscosity based on topoenergetic principles. 2. Topological aspects of flow and deformation in polymer composites, The VIII-th International Congress on Rheology, 1-5 September 1980, Naples, Italy, pp. 375-376. 3. Universal representation of flow behavior based on topoenergetic principles, The IX-th International Congress on Rheology, 8-13 October 1984, Accapulco, Gro. Mexico, pp.369-376. 4. Comments on "Universal representation of flow behavior based on topoenergetic principles", The IX-th International Congress on Rheology, 8-13 October 1984, Accapulco, Gro. Mexico, pp. 369-376. 5. Open letter to BRML and INM.	F
2014	18	1	Adiabatic calorimeter as high accuracy T-calibrator	F
2014	18	2	Mental field-water interaction as evidenced by Isothermal Convection Flow Calorimetry (ICFC). II. Effect of convection flow power.	F
2014	18	3	Eurovision song contest. II. Copenhagen, Denmark 2014 and some more features on social mentality.	F
2014	18	4	The 38th Congress of American-Romanian Academy (ARA) of Arts and Sciences, 23-27 July 2014, Pasadena, California, USA	F
2015	19	1	Gold versus money. 1. An overview on main financial figures of world countries.	F
2015	19	2	Gold versus money. 2. Rich, middle and poor countries.	F
2015	19	3	High Resolution Mixing Calorimetry (HRMC) redivivus. 1. General presentation and heat capacity measurements.	F
2015	19	4	High Resolution Mixing Calorimetry (HRMC) redivivus. 2. Structure developing of aqueous solutions by mixing experiments.	F

*) F=free, AFI=ask for invoice.

ERRATA:

VOL	NO	place	was written	must be
15	2	Figure 5	P+	P-
15	3	page 5, row 7 down-to-up	x=2	x=0.2

I encourage readers to advice me any observation.

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