

WG on Hardness Report

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Presented by Walter Bich

Proposed slightly revised Terms of Reference

- 1) To advise the CCM on matters relating to hardness;
- 2) To improve harmonization of primary standards by developing new primary definitions and/or organizing pilot studies;
- 3) To organize key comparisons for supporting the CIPM MRA;
- 4) To support activities of RMOs;
- 5) To produce working documents for the evaluation of uncertainty;
- 6) To maintain good links and interface with the hardness community (IMEKO TC5); and
- 7) To provide formal liaison among organizations involved in the standardization (ISO TC164/SC 3, OIML TC10/SC 5, ASTM international TCE28.06).

Program of work of the WGH for the next 5 years

Hardness fields in which it is foreseen to have further activities to improve the measurement traceability through development of primary definitions and organization of KCs and pilot Studies:

- instrumented indentation test,
- nano-indentations,
- dynamic hardness,
- portable hardness testers,
- hardness of elastomers,
- Martens hardness,
- Leeb hardness.

Program of work of the WGH for the next 5 years

It is already decided to carry on:

- Activity in the development of international primary definitions for Brinell, Vickers and Rockwell scales (about 2 years each – activity already started in 2011 – end of activity on 2015),
- KCs in different hardness scales (HRB, HRN, HBW, HSD, HL) (2013 – 2020).

Present Membership (NMIs and individuals)

	<i>Institute</i>	<i>Country</i>	<i>Delegate</i>	<i>Technical Experts</i>
1	CENAM	Mexico	Alfredo Esparza Ramírez	
2	GUM	Poland	Anna Osinska-Karczmarek	
3	INMETRO	Brazil	Renato Reis Machado	Sergio Pinheiro de Oliveira
4	INRIM	Italy	Alessandro Germak	
5	KEBS	Kenya	David Kimetto	
6	KRISS	Korea, Republic of	Gun Woong Bahng	Junhee Hahn, N. H. Tak
7	LNE	France	Stéphane Lefrançois	
8	NIM	China	He Li	
9	NIMT	Thailand	Sanponpute Tassanai	Rugkanawan Wongpithayadisai
10	NIST	United States of America	Samuel Low	John Song
11	NMIJ	Japan	Koichiro Hattori	Satoshi Takagi
12	NMISA	South Africa	Benny Burke	Corné Gouws
13	NPL	United Kingdom	Andy Knott	Nigel Jennett
14	PTB	Germany	Febo Menelao	
15	SMU	Slovakia	Robert Spurný	
16	SP	Sweden	Leslie R. Pendrill	
17	UME	Turkey	Cihan Kuzu	
18	VNIIFTRI	Russian Federation	Edward Aslanyan	Vasily Shlegel, Andrey Aslanyan
19	VNIIM	Russian Federation	Natalia G. Domostroyeva	
20	VSL	Netherlands	Gerard Kotte	

No proposal for new membership

WGH Meetings held since last CCM

- 14th Meeting — 11 September 2012 - BEXCO (Busan Exhibition and Convention Center), Busan, Republic of Korea (in coincidence to the XX IMEKO World Congress 2012 held that week in the same location)
- 13th Meeting — 21 September 2011 - Bureau international des poids et mesures (BIPM) - Sèvres, Cedex, France (in coincidence to the meetings of ISO TC 164 Mechanical testing of metals held that week in Paris).

WGH Meetings planned

The next meeting will be held either:

- in conjunction with the meetings of ISO TC 164 in Ijmuiden, The Netherlands at Tata Steel occurring 16-20 September 2013; or
- in conjunction with the 12th HARDMEKO Conference on the Measurement of Hardness, Cape Town, SOUTH AFRICA, 03-07 February 2014.

Liaisons with RMO KCs

RMO and Name	Scale	Year	Hardness levels	Status
APMP.M.H- K1.b	Vickers 1	2003/2004	200 HV, 600 HV and 900 HV	In progress
APMP.M.H- K1.c	Vickers 30	2003/2004	200 HV, 600 HV and 900 HV	In progress
APMP.M.H- S1	Rockwell C	2004/2005	20 HRC to 60 HRC	Approved and published
APMP.M.H- S2	Rockwell A and B	2009	35 HRA to 85 HRA, and 25 HRB to 100 HRB	Approved and published
APMP.M.H- S3	Rockwell A and B	2010/2010	35 HRA to 85 HRA, and 25 HRB to 100 HRB	Approved and published
APMP.M.H- S4	Rockwell C	2011	30 HRC, 45 HRC and 60 HR	Planned
COOMET.M.H-K1	Vickers HV1, HV5, HV30	2007/2010	400 HV, 700 HV	Protocol complete
COOMET.M.H-K1.b	Vickers 1	2004	240 HV, 540 HV and 840 HV	Report in progress, Final report
COOMET.M.H-K1.c	Vickers 30	2004	240 HV, 540 HV and 840 HV	Report in progress, Final Report
COOMET.M.H-K2	Brinell Hardness	2007/2010	100 HBW, 200 HBW, 400 HBW	Protocol complete
COOMET.M.H-S1	Rockwell and Super-Rockwell	2007/2008		Approved and published

KCs underway

- CCM.H- K2 Brinell Hardness scale (2003 – 2004)

Comparison type, Field Key comparison in Mass, Hardness
Status Report in progress, Draft A

Problems: Measurements obtained by laboratories that have used a low Numerical Aperture (N.A.) are affected by systematic errors. This parameter has not defined in the tech. protocol. At the last WGH meeting the Pilot proposed to correct the effect of a low N.A., and the proposed correction procedure will be sent to the participants.

KCs underway

- CCM.H- K3 Hardness Rockwell C (HRC) scale (2011 – 2012)
Comparison type, Field Key comparison in Mass, Hardness
Status Planned (Measurements should start in few weeks)
- Pilot study on Rockwell diamond indenters (measurements in progress)

KCs planned

- Brinell (selected scales to be determined)
- Rockwell B scale (HRB)
- Rockwell superficial diamond scales (HR15N, HR30N and HR45N)
- Shore hardness D scale (HSD)
- A KC related to Instrumented Indentation Testing (IIT) was also suggested.

The current and planned KCs are sufficient for CMCs in hardness field

Major successes and problems (since last CCM)

- Major successes

Continuous development of international primary definitions of hardness scales. It has been deeply discussed and analyzed the Brinell hardness scales.

Organization of the Rockwell C KC.

- Major problems

Problems in the Brinell KC; however, the discussion of these problems (Numerical Aperture) has been very useful for the development international primary definition of the Brinell scale.

Technology trends and challenges in hardness field

The Working Group on Hardness (WGH) deals with Hardness standards and promotes the international cooperation among NMIs, DIs, RMO members and international organization like ISO, ASTM, OIML, VAMAS and others, for improving traceability and standardization in the field.

It is foreseen and increment in demand of traceability in the instrumented indentation test, nano-indentations, dynamic hardness, portable hardness testers, hardness of elastomers and Leeb hardness.