



Report of the CCM Working Group on Hardness

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19th CCM meeting, 25-26 May 2023

CONSULTATIVE COMMITTEE
FOR MASS AND RELATED QUANTITIES

WG Meetings held since last CCM

– One meetings since last CCM meeting (Mai 2022)

- 27. October 2022 virtual meeting, 13 participants, 4 hours
- Short online meeting
- Different time zones
- Not ideal communication
- Discussions neighbourly missing
- Updating status, comparisons, pilot studies, CMCs

WG Meetings planned

– Next WGH meeting

- 28. September 2023
- During ISO meetings
- ISO TC 164: Mechanical testing of metals 25.09.-29.09.2023
- At the ASTM headquarters, West Conshohocken (USA)
- In person meeting, many persons available there
possible with virtual participants (bad time for some countries)

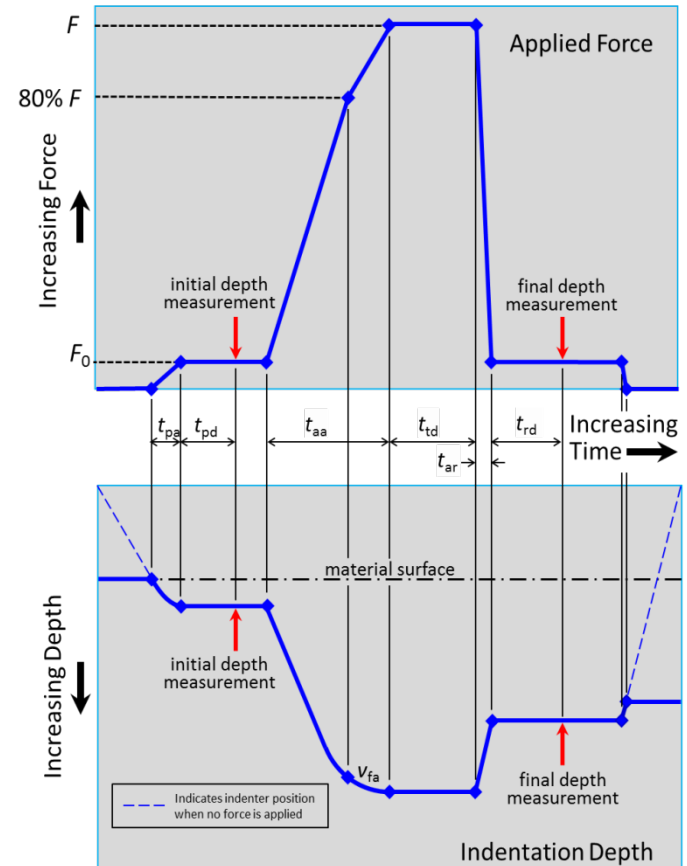
Main actions taken and main achievements

- Improving the definition of hardness measurement technology;
- To review the results of completed key and supplementary comparisons and plan and support new comparisons;
- To facilitate the submission and review of CMCs by establishing technical review criteria and service categories and providing guidance on and coordinating the review process;
- To provide liaison at the technical level with ISO TC164/SC3 and to maintain good links with IMEKO TC5.

Progressing the state of the art

– Develop additional hardness test definitions for the Brinell, Vickers, Knoop, Leeb and Rockwell hardness

- Definitions for HRC and HRxxN finished
- Definitions for HRA and HRD: Timetable, indenter speed by increasing force
- Definitions for HRB, HRxxT also HB: Indenter material (Wolfram carbide composite), elastic properties, chemical compositions, timetable, indenter speed by increasing force



Liaison & stakeholders

- **IMEKO TC5 – Hardness Measurement**
 - Most publishings in research and developments
- **ISO/TC 164 Mechanical testing of metals**
 - ISO/TC 164/SC 3 – Hardness
 - ISO TCs for rubber and plastics
 - ISO TCs for mechanical properties for layer

Liaison & stakeholders

– Industry

- Manufacturers of hardness reference blocks and
- Manufacturers of hardness testing machines
- Calibration and testing laboratories in hardness
- Steel, Rubber and Plastic Industry
- Car Industry, Aircraft & Space Travel Industry

KCs completed and underway

Comparison Identifier	Description	Measurement period	Pilot institute	Status
CCM.H-K1.a	Hardness (Vickers 0.2)	2001 - 2003	PTB	Approved for equivalence
CCM.H-K1.b	Hardness (Vickers 1)	2001 - 2002	PTB	Approved for equivalence
CCM.H-K1.c	Hardness (Vickers 30)	2001 - 2002	PTB	Approved for equivalence
APMP.M.H-K1.b	Hardness (Vickers 1)	2003 - 2005	NMIJ AIST	Approved for equivalence
APMP.M.H-K1.c	Hardness (Vickers 30)	2003 - 2005	NMIJ AIST	Approved for equivalence
APMP.M.H-S1	Hardness (Rockwell C)	2004 - 2005	NIMT	Approved
COOMET.M.H-K1.b	Hardness (Vickers 1)	2004	PTB	Approved for equivalence
COOMET.M.H-K1.c	Hardness (Vickers 30)	2004	PTB	Approved for equivalence
COOMET.M.H-S1	Intercomparison in the field of Rockwell and Super-Rockwell hardness scales	2007 - 2008	PTB	Approved
COOMET.M.H-K1	Hardness (Vickers HV1, HV5, HV30)	2006 - 2009	VNIIFTRI	Approved for equivalence
COOMET.M.H-S4	Brinell Hardness	2007 - 2010	VNIIFTRI	Approved
APMP.M.H-S2	Hardness (Rockwell A and B)	2009	NIMT	Approved
APMP.M.H-S3	Hardness (Rockwell A and B)	2009 - 2010	NIMT	Approved
APMP.M.H-S4	Hardness (Rockwell C)	2011	KRISS	Report in progress, draft A
COOMET.M.H-S2	Bilateral comparison of national reference instruments for nanoindentation	2014 - 2016	VNIIFTRI	Report in progress, draft A
COOMET.M.H-S3	Comparison of national hardness standards of Superficial-Rockwell scales	2014 - 2016	NSC IM	Approved
COOMET.M.H-S5	Key comparison of national hardness standards of Rockwell scales	2013 - 2016	NSC IM	Approved
APMP.M.H-S5	Hardness (Brinell)	2018	NIMT	Approved
APMP.M.H-S6	Hardness (Vickers)	2018	NIMT	Approved
EURAMET.M.H-K1.b	Hardness (Vickers1)	2018	INRIM	Approved for equivalence
EURAMET.M.H-K1.c	Hardness (Vickers 30)	2018	INRIM	Approved for equivalence
EURAMET.M.H-S1.a.b.c	Hardness Rockwell (HRA, HRB and HRC)	2018	INRIM	Approved
EURAMET.M.H-S2.a.b	Hardness (Brinell)	2018	INRIM	Approved
APMP.M.H-S7	Comparison of hardness for scales Shore A and IRHD N	2019	NIMT	Planned
CCM.H-K3	Hardness Rockwell C (HRC) scale	2021 - 2022	INRIM	Protocol complete

KCs planed

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APMP.M.H-S7	Comparison of hardness for scales Shore A and IRHD N	2019	NIMT	Planned
CCM.H-K3	Hardness Rockwell C (HRC) scale	2021 - 2022	INRIM	Protocol complete

— Also planned:

- A Leeb hardness comparison after the Pilot study is accepted
- A Indenter geometrie comparison for Rockwell cone indenter

— Exclude some CCM countries

Program of work for the next 2 years

- Develop additional hardness test definitions for the Brinell and Rockwell hardness
- Develop unified format for reporting hardness CMCs

Rockwell A	
Rockwell B	
Rockwell C	
Rockwell N	HR15N, HR30N, HR45N
Rockwell T	HR15T, HR30T, HR45T
IRHD-N	
Vickers HV 0.01 to HV 0.2	
Vickers HV 0,3 to HV 1	
Vickers HV 2 to HV 10	
Vickers HV 20 to HV 125	
Brinell HB 1/1 to HB 1/30	
Brinell HB 2.5/15.625 to HB 2.5/187.5	
Brinell HB 5/62.5 to HB 5/750	
Brinell HB 10/100 to HB 10/3000	

Program of work for the next 2 years

- Initiate new Key Comparisons [KC should not occur until definition is developed & approved]
- Setting a schedule for KCs and Pilot Studies is difficult and has been varied in recent years
 - Re-initiate [CCM.H-K3] Rockwell C hardness (HRC): Key Comparison
 - NEW Key Comparison for the Geometrical Measurement of the Rockwell Diamond Indenter. Request CCM Approval now in case the KC can be done in coincidence with the [CCM.H-K3] Rockwell C hardness (HRC) KC
 - Rockwell N (HR15N, HR30N and HR45N): Key Comparisons
 - Brinell (HBW scales to be determined): Key Comparison
 - Leeb hardness: Key Comparison
 - Geometrical Measurement of the Vickers and Knoop Diamond Indenters: Pilot Studies
- All needs more than 2 years

Proposed changes (membership, chairmanship, ToRs)

- No changes by the chairs
- Member from NIMT
 - Dr. Montree Pakkratoke has just resigned from NIMT
 - Mr. Nitiwat Sasom (Deputy head of hardness laboratory) NIMT participate the next WGH meeting as an observer

Thank you.

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