Non-contact Surface Hardness Variation Scanner

muraR

What 'muraR' can do?

High speed scanning of 'Hardness Variation' of surface of steel by non-contact and non-destructive inspection!

①Convert shape of X-ray diffraction profile data (correlated with hardness) to voltage

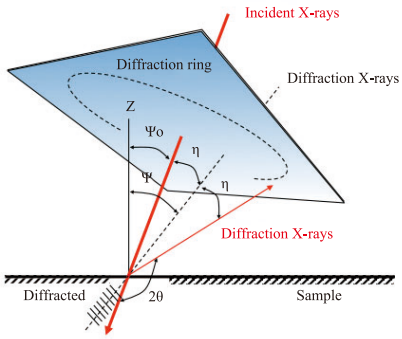
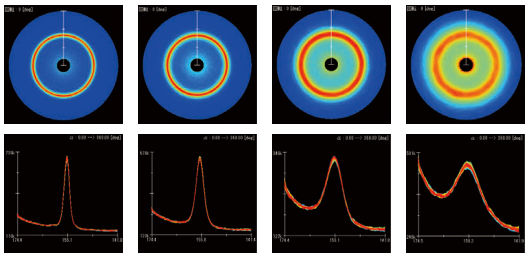
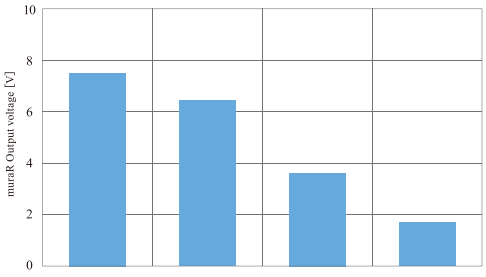


Image of Debye ring and X-ray Profile by μ-X360



(HRC specimen from Yamamoto Scientific Tool Research Co., Ltd.)

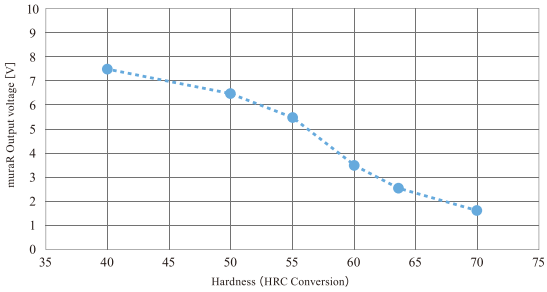
Shape of profile data (Hardness) VS Output voltage



Hardness specimens (HRC specimen from Yamamoto Scientific Tool Research Co., Ltd.)

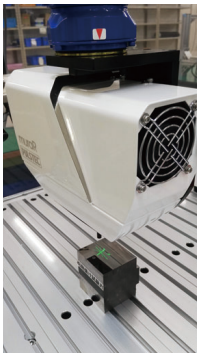
②Calibrate output voltage to Hardness

Calibration 1: HRC specimens (40～70)

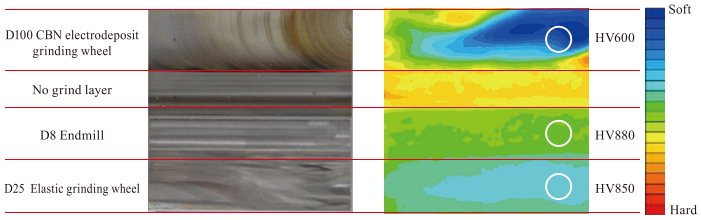


Enable to save maximum 16 calibration information (e.g. HRC, Hv).
Enable to switch calibration information according to each measurement.

③Auto scan function by stage or robot / Color mapping display of hardness variation



■Grinding burn specimen 60×60mm ■Measurement image of muraR



Tool	Rotational speed (rpm)	Feed speed (mm/min)	ap (mm)	ae (mm)
D100 CBN electrodeposit grinding wheel	12000	100	0.05	13
D8 Endmill	3100	450	0.02	1.2
D25 Elastic grinding wheel	18000	5	0.06	15

Applications

①Evaluation for machining burn or grinding burn

【Current process】
Pick up sample from product → Nital etching →
→ Visual inspection → Dispose sample

Skill for etching is needed. Difficult to evaluate color of etching.

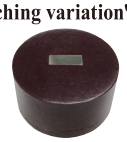
【muraR】
Product → Scan hardness variation

Easy to evaluate by color and value.

Reduce cost	①Enable to reduce the cost of production and disposal for evaluating sample. ②Enable to reduce time for inspection. (e.g. Nital etching : 1 hour → muraR : 20 minutes)
Improve reliability	①Judge the result by value. ②Enable to improve inspection frequency due to the shorter term for the inspection. (e.g. Evaluate products of all production lots)
Improve safety / Environment	①Safety and ecology due to nital etching (hazardous process) is not needed. ②Low power X-ray output (Safe environment at 3m away from sensor unit.)

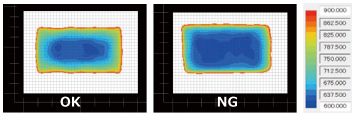
②Inspection of 'hardening layer' and 'quenching variation' after heat treatment

【Current process】
Cut the sample → Resin embedding → Polishing →
→ Microscope Observation and Hardness test



・Long process for testing is needed.
・Difficult to evaluate whole surface.

【muraR】
Cut the sample →
→ Buff polishing →
→ Scan the hardness
→ variation



Enable to check hardening layer by mapping image.

Reduce cost	①Enable to reduce cost for disposal due to resin embedding process is not needed. ②Enable to reduce time for inspection. (e.g. Hardness test : 1 hour → muraR : 20 minutes)
Improve reliability	Evaluate hardness variation of whole surface by value.
Environmental protection	Reduce disposal loss of resin embedding process.

Specifications

X-ray	Cr 30kV 1.6mA Air cooling
Spot size	Φ3mm (Can be replace by user)
Sample distance	45mm ±1mm from detector
X-ray irradiation angle	Vertical to measurement sample (Tilted angle to measurement sample would be possible by the adjustment)
Output	Analogue output 0-10V
Sensor unit	W140×L204×H157mm 3.8kg(not included marker)
Power supply unit	W140×L252×H193mm 6.2kg
Material for measurement	Only steel
Hardness	HRC45 / Hv500 or more(Recommended)

Measurement speed

Scanning speed vs Hardness measurement resolution' and 'X-ray spot size vs Area resolution ' are in the relationship of trade-off.

X-ray spot size	Recommended measurement time for 10mm2 area ※3	Recommended scan speed ※2
Φ1mm	40minute	0.3mm/s
Φ3mm ※1	2minute	3mm/s
Φ5mm	1minute	8mm/s

※1 Standard X-ray spot size is 3mm. (1mm and 5mm is optional)
※2 Recommend scan speed : Accuracy = approx. HRC±1(approx. Hv±15)
※3 Measurement time would be varied according to the scanning method.

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