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COULOSCOPE® CMS2
COULOSCOPE® CMS2 STEP

Measurement of Coating Thickness and Electrochemical Potentials according to the Coulometric Method.



COULOSCOPE® CMS2 Models

Models

COULOSCOPE CMS2	It is the ideal instrument for measuring the thickness of virtually any metallic coating on metallic or nonmetallic substrates, especially also of multiple coatings, if non-destructive methods cannot be used.
COULOSCOPE CMS2 STEP	In addition to the coating thickness measurement corresponding to the COULOSCOPE CMS2, the COULOSCOPE CMS2 STEP provides functions for the STEP test measurement according to ASTM B764 - 94 and DIN 50022. The COULOSCOPE CMS2 STEP is ideally suited to measure the individual coating thicknesses and the potential differences of multiple nickel coatings in a simple standard-conforming manner.

Description

The COULOSCOPE CMS2 instruments measure the thickness of virtually any metallic coating on metallic or nonmetallic substrates.

Instrument features

- Measurement of single coating and multi coating systems
- Graphical display for clear view of the measurements, the set coating system and the parameters as deplating rate and test area size
- Graphical display of the cell voltage on the LCD screen
- Many predefined measurement applications for the most metal coatings
- Selectable measurement units: µm or mils
- European, south american and asian display languages

Special features	**COULOSCOPE CMS2**	**COULOSCOPE CMS2 STEP**
	• Evaluation of measurement data in table or graphic format • Automatic or manual measurement switch-off	• The same features as already described under COULOSCOPE CMS2 **Additional for the STEP Test measurement** • Adjustable deplating amperage • Determination of the coating thicknesses and potential differences using the cursor • Automatic measurement sequence for conditioning the silver reference electrode (generation of the required AgCl coating)

Application	**COULOSCOPE CMS2**	**COULOSCOPE CMS2 STEP**
Examples	• Multi coatings: Cr/Ni/Cu on iron • Dual coatings: Sn/Ni on silver • Single coatings: Zn on iron	• Single and multi coatings as already described under COULOSCOPE CMS2 • STEP Test measurement: 4-nickel-coating system on iron, aluminum or ABS

System Overview



V18



V24



V26



V27



PC
to evaluate and store data and to create custom print-form templates

Printer
to document the measurement results

Evaluation

All instruments	• Statistics: Display of mean value, standard deviation, coefficient of variation, range, lowest and highest measurement • Graphical evaluation: histogram (30 measurements minimum), normal probability chart, specification limits, process capability indices, expected value of the standard deviation and standard deviation of the blocks
additional for COULOSCOPE CMS2	The evaluation of the STEP Test plots can be carried out directly at the instrument.
PC software, within scope of supply of the COUOSCOPE CMS2 STEP	The PC software program STEP-View is available to save and to conveniently evaluate the measured potential plots from the STEP Test measurement. The determination of the coating thicknesses and of the potential differences occurs in two separate diagrams. The interesting values can be easily determined by positioning up to 5 markers at the relevant sections of the plot. The data can be exported to an Excel spreadsheet, the plots can be saved in popular graphic formats and extensive printform templates can be set up.

Stands

V18	Stand for big and small parts with random forms. A support arm is available for middle and small parts. Controlled filling and emptying of the cell by means of a pump. Multiple measurements with one cell filling are possible. A warning advise occurs when the electrolyte becomes saturated and the measuring cell filling must be changed.
V24	Stand with free swiveling support plate for middle and small parts with random forms.
V26	Stand for small parts with plane surfaces measurable without special specimen support.
V27	Stand, especially for coating thickness measurements at wires.

General features

Measurement method	Coulometric method DIN EN ISO 2177, Metallic coatings - Measurement of coating thickness - Coulometric method by anodic dissolution. Further description see page 7.
Test area sizes	∅ 3.2 mm *(125 mils)*; ∅ 2.2 mm *(86.6)*; ∅ 1.5 mm *(59 mils)*; Stand V18 additional ∅ 0.6 mm (*23.6 mils)*
Deplating rate	0.1 to 50 µm/min *(0.004 to 1.968 mils/min)* selectable
Measurement applications	• 73 predefined standard measurement applications for most metal coatings • 14 predefined standard measurement applications for coating thickness measurements at wires • 2 predefined standard measurement applications for STEP Test measurements (only instrument model CMS2 STEP)
Calibration	During calibration, a correction factor (calibration factor) is determined. This correction factor may be required due to production tolerances in the cell gasket diameter, and to variations in coating material density or alloy composition of the coating material. For STEP Test measurements a factor can be entered.
Applications	Applications are areas of memories where measurement application specific parameters (such as standard or special measurement application, calibration factor, unit of measurement, etc.) and the measurement data are stored. Applications can be copied, edited and deleted.

Display	Graphical display, 116 mm x 87 mm *(4.6 " x 3.4 ")*
Languages	German, English, French, Italian, Spanish, Portuguese, Portuguese (Brazil), Czech, Turkish, Japanese, Chinese PRC (simplified), Chinese traditional (Taiwan)
Memory	Max. 3000 measurements in 600 blocks can be distributed over a maximum of 50 applications (memories)
Admissible ambient temperature range during operation	+10 ... +40 °C *(+14 °F ... +104 °F)*
Data tranfer	Single readings only
Mass	2.6 kg *(5.7 lb)*
Dimensions (W x H x D)	Instrument: 340 mm x 140 mm x 200 mm *(13.4 " x 5.5 " x 7.8 ")*
Supply voltage	110 ... 230 V AC +10 %, -15 %; 50 ... 60 Hz, via AC line adapter 110-220 V_{AC}/12V_{DC}

Instrument connectors

USB	• 4 USB connectors type A (flat), for printer, commercially available PC keyboard and PC mouse; 2.0 compatible • USB connector type B (square), for connecting a PC, 2.0 compatible
Stand connector	25 pin Mini D Sub plug (connecting cable to the instrument within the scope of supply of the stand)
Auxiliary silver electrode connector	2 banana jacks for connecting the auxiliary silver electrode at the STEP Test measurement, only relevant for the instrument model COULOSCOPE CMS2 STEP
Power supply	Connector for the AC line adapter12V_{DC}/3A (AC line Adapter with 1.8 m *(5.9 ft)* power cord within the scope of supply of the instrument)

Measurement range

depends on the combination of coating and base material	0.5 ... 50 µm *(0.02 ... 1.97 mils)*

Measurement applications

Measurement application (Coating/Base material) For multi-coating systems, the respective coating underneath the coating to be measured is considered the base material.	Smallest measurable coating thickness [µm, *mils*]									Largest measurable coating thickness [µm] *(mils)*	Electrolyte type	Reference standard
	0.015 *0.00059*	0.03 *0.0012*	0.07 *0.0028*	0.15 *0.0059*	0.3 *0.012*	0.7 *0.028*	1.5 *0.059*	3 *0.12*	*7 0.28*			
	Deplating speed [µm/min, *mils/min*]											
	0.1 *0.0039*	0.2 *0.0079*	0.5 *0.0197*	1.0 *0.039*	2.0 *0.079*	5.0 *0.197*	10.0 *0.39*	20.0 *0.79*	50.0 *1.97*			
Ag / Fe, Ni, Al, Nc					●	●	●	●[1]	●[1]	50 *(2)*	F4	Ag/Fe
Ag/Cu				●	●[1]	●[1]				50 *(2)*	F8	Ag/Cu
Ag/Cu							●	●	●	50 *(2)*	F18	Ag/Cu
Ag/Cu, CuZn*				●	●[1]					*5 (0.2)*	F17	Ag/Cu
CuZn*/Fe			●**	●**	●**	●**	●**			50 *(2)*	F4	Upon request
Cr/Fe, Ni, Al, Nc	●	●	●	●	●	●	●	●[1]		50 *(2)*	F1	Cr/Fe
Cr/Cu, CuZn*	●	●	●	●	●	●	●	●[1]		50 *(2)*	F9	Cr/CuZn*
Cu/Fe, Ni, Al, Nc				●	●	●	●	●		50 *(2)*	F4	Cu/Fe
Cu/CuZn*, Zn, Zn die casting					●	●				10 *(0.4)*	F5	Cr/CuZn*
Ni/Fe, Al, Cu, CuZn*, Nc					●[2]	●[2]	●[2]	●[2]		50 *(2)*	F6	Ni/Cu
NiP (Ni currentless)/Fe, Al					●	●	●			50 *(2)*	F7	Upon request
Sn/Fe, Ni, Cu, CuZn*, Nc				●	●	●				50 *(2)*	F9	Sn/Ni
Sn/Fe, Ni, Cu, CuZn*, Nc						●	●	●		50 *(2)*	F12	Sn/Ni
Sn/Al				●**	●**	●**	●[1,**]	●[1,**]		50 *(2)*	F1	Sn/Al
Sn60Pb40/Fe, Ni, Al, Cu, CuZn*, Nc				●	●	●	●	●[1]		50 *(2)*	F4	Sn60 Pb40/Fe
Pb/Fe, Cu								●**		50 *(2)*	F4	Pb/Fe
Zn/Fe, Ni, Al					●	●	●	●[1]		50 *(2)*	F11	Zn/Fe
Zn/Cu, CuZn*					●	●	●	●[1]		50 *(2)*	F10	Zn/CuZn*
Wire measurement applications[3]												
Ag/Cu wire					●					4 *(0.16)*	F8	
Cu/Fe, Ni wire		●	●	●						2 *(0.08)*	F4	
CuZn*/Fe wire				●						2 *(0.08)*	F4	
Ni/Fe wire					●	●				10 *(0.4)*	F6	
Zn/Fe wire						●				10 *(0.4)*	F11	
Sn/Cu wire					●	●				10 *(0.4)*	F12	
Sn60Pb40/Cu wire				●	●	●	●			20 *(0.8)*	F4	
STEP-Test measurement appliations[4]												
Ni-S/Fe, Al, Cu, CuZn*						●		●		40 (1.6) per coating	F22	

*: CuZn (brass), Terminology in accordance with ISO recommendation
**: no multiple usage of the electrolyte
Nc: Non-Metal
1: These measuring applications cannot be measured using type 06 measuring cell (support stand V18)
2: For these measuring applications, the multiple usage of the electrolyte is limited to a total deplatable coating thickness of 40 µm (1.57 mils).
3: For measuring these applications the stand V27 is necessary
4: For measuring these applications the instrument model COULOSCOPE CMS2 STEP is necessary

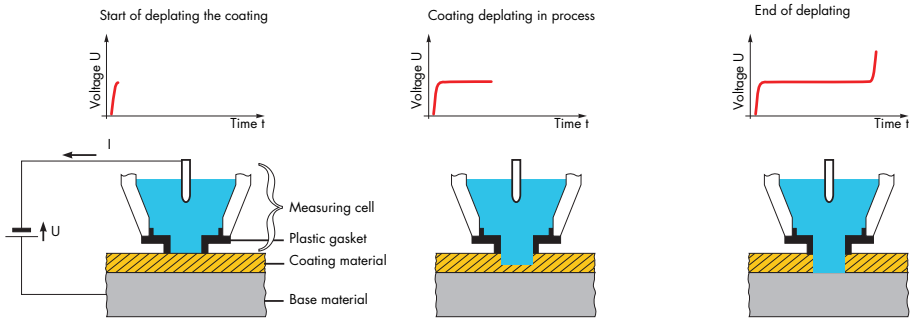
Measurement method

Coulometric method by anodic dissolution, DIN EN ISO 2177

Description

The metallic coating is removed from its metallic or non-metallic substrate by the passage of electric current under controlled conditions – in fact, the reverse of the electroplating process. The electric current applied is directly proportional to the metal mass to be deplated. The result is a clear correlation between deplating time and coating thickness, provided the deplating current and the deplating area remain constant. A measuring cell – comparable to an electrolytic miniature bath – is used to deplate the coating. The measurement area is defined by a plastic gasket placed on the cell.

Schematic presentation



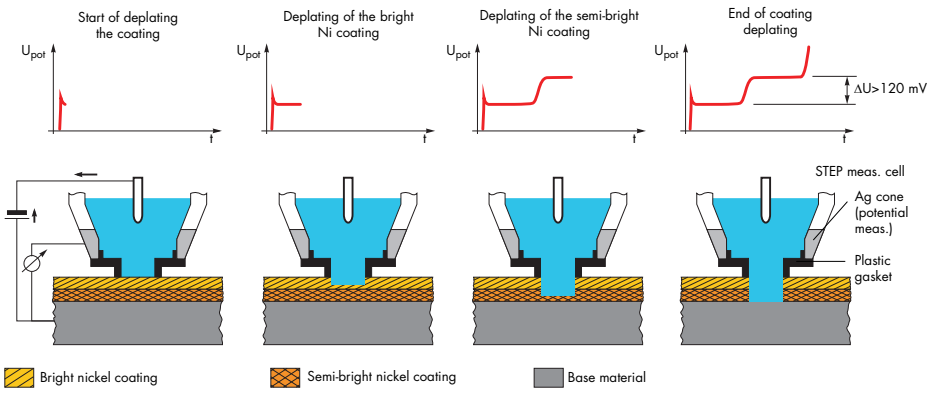
STEP Test (Simultaneous Thickness and Electrochemical Potential determination)

Description

STEP-Test is a measurement method that has been standardized for a long time to determine simultaneously individual coating thicknesses and the electrochemical potential differences between individual coatings of a nickel coating system. The coating thickness measurement is carried out according to the coulometric method as described above. The potential profile is captured using a silver reference electrode coated with AgCl. The potential profile is shown on the display and the individual coating thicknesses and the potential differences can be determined through respective cursor positioning on the plot. To obtain comparable measurements with the potential measurement method, the reference electrode must always have the same distance from the specimen. This is accomplished using a special measurement cell*. The silver reference electrode is designed as a cone-shaped ring electrode and forms the lower housing component of the measurement cell, where only the necessary measurement cell gasket is placed. This design of the measurement cell ensures a consistently uniform distance between the reference electrode and the specimen.

* Property rights applied for

Schematic presentation



Order Information and Scope of Supply

COULOSCOPE CMS2	605-086	Standard content of shipment: measuring instrument, AC line adapter with 1.8 m *(5.9 ft)* power cord, Operator's Manual
COULOSCOPE CMS2 STEP	605-087	Standard content of shipment: measuring instrument, AC line adapter with 1.8 m *(5.9 ft)* power cord, operator's manual, connecting cable CMS STEP – measuring cell STEP (0.8 m *(2.6 ft)*), conditioning plate STEP, software program STEP-View for data storage and evaluation, PC connecting cable
Stand V18	605-091	Standard content of shipment: measurement stand, support arm with swiveling support plate, accessory case with special eraser, replacement electrode, round brush, plastic cell gaskets with test area diameters of 3.2 mm *(125 mils)*, 2.2 mm *(86.6 mils)* and 1.5 mm *(59 mils)*, measuring cell replacement o-ring seals, circular level, grounding cable and centering device, measuring cell type 15/32, measuring cell base STEP 603-545, 3 plastic bottles of 1 l and 3 electrolyte bottles of 100 ml each, connecting cable V18 - instrument (2 m *(6.6 ft)*)
Stand V24	600-782	Standard content of shipment: measurement stand, accessory case with special eraser, replacement electrode, wire brush, plastic gaskets with test area diameters of 3.2 mm *(125 mils)*, 2.2 mm *(86.6 mils)* and 1.5 mm *(59 mils)*, blind gaskets, circular level, ground cable, measuring cell, measuring cell STEP 603-546, 3 mm right angle hex key, transfer pipette, burette, 3 plastic bottles of 100 ml, 1 wash bottle and 1 plastic beaker, protective cover, cable V24 - instrument (2 m, *(6.6 ft)*)
Stand V26	600-783	Standard content of shipment: measurement stand, accessory case with special eraser, replacement electrode, wire brush, plastic gaskets with test area diameters of 3.2 mm *(125 mils)*, 2.2 mm *(86.6 mils)* and 1.5 mm *(59 mils)*, blind gaskets, circular level, ground cable, measuring cell, measuring cell STEP 603-546, 3 mm right angle hex key, transfer pipette, burette, 3 plastic bottles of 100 ml, 1 wash bottle and 1 plastic beaker, protective cover, cable V26 - instrument (2 m, *(6.6 ft)*).
Stand V27	600-784	Standard content of shipment: measurement stand, stainless steel beaker, lid for beaker, accessory case with stirrer bar, special eraser, connecting cable V27 - instrument (2 m, *(6.6 ft)*).

Optional Accessories

COULOSCOPE CMS2 STEP	603-546	Measuring cell STEP V24/26
	603-545	Measuring cell STEP V18, Base STEP
Stand V18	602-843	Measuring cell storage bracket
	602-837	Measuring cell type 0.6
	602-839	Support arm for bearing shells
	602-841	Support arm for magnetic holder
	602-840	Ball-jointed specimen support
Stands V24 and V26	600-802	Bottle holder
	600-854	Magnetic holder
	600-790	Special measuring cell with integrated electrode
Electrolyte		Suitable to the measurement application various electrolytes are available.
Calibration standards		Various standards are available for calibration.

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