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Starting to sell
"Seebeck Coefficient / Electric Resistance Measuring System ZEM-5 series"
corresponding to the features of various kinds of thermoelectric materials

ULVAC-RIKO, Inc.

ULVAC-RIKO, Inc.（Head office: Yokohama, Kanagawa; President and CEO: Yoshikazu Ishii）has developed "Seebeck Coefficient / Electric Resistance Measuring System ZEM-5 series" specialized in each application and will start to sell from July.

We have developed and are now selling "Seebeck Coefficient / Electric Resistance Measuring System ZEM-3" corresponding to the performance evaluation of thermoelectric materials.
Recently, effectively using energy has been encouraged along with the emission reduction of CO_2. The requests for power saving have been increased and the developments of energy saving technique have been accelerated since last year's East Japan earthquake.
Attentions to thermoelectric materials have been drawn as a maintenance free and a clean technology since they are converted to electricity from heat without any driving part.
As developments of thermoelectric materials have been advanced, the performance evaluation with high level for various kinds of materials has been pursued. We have developed "ZEM-5 series" specialized in the features of various kinds of materials such as high temperature materials, high resistance materials and thin films, and so on. We have supplied thermoelectric materials evaluation system to respond to the detailed requirements of various kinds of materials.

"Seebeck Coefficient / Electric Resistance Measuring System ZEM-5 series" which we are ready to start to sell, specializes in the specification corresponding to features of various kinds of materials.
We adopted C type thermocouple with low reaction as Si series thermoelectric materials. We reviewed measurement system to measure higher resistance (Actual measurement:10MΩ) which are equal to that of oxide thermoelectric materials. We have developed optimization of sample assembly and measurement method to evaluate thin films (nano order), low-middle temperature type specialized in the needs of evaluation at close to room temperature and the evaluation of small sample with a few millimeter.

【Features】

- A series of performance evaluation of various thermoelectric materials with optimization.
- Adopting C type thermocouple for optimum evaluation of Si series thermoelectric materials (SiGe、MgSi).
- Diagnostic program of thermocouple to be equipped as a standard accessory.
- Capable of controlling temperature up to 1200℃(HT-high temperature type).
- Capable of corresponding to high resistance up to (Actual measurement:10MΩ).
  (HR-high resistance type).
- Capable of film measurements deposited on substrate(TF- thin film type).
- Capable of the temperature control between -150℃ and 200℃
  (LT-low-middle temperature type).

◎ Main specification

- Thermal properties: Seebeck coefficient and electric resistance.
- Sample size: 2 - 4mm square or 2 - 4mmφx 3 - 15mm long (High temperature HT type).
- Thin film: Capable of confirming electric current nano order thin film deposited on the substrate of width 2- 4mm、thickness 0.4 - 1.2mm、and length 20㎜ through insulating layer (TF type).
- Measurement accuracy: Seebeck coefficient :±7 %.
  Electric resistance:±7% (Excluding sample under 5mm long).
- Temperature range: 100 - 1200 ℃ (HT High temperature type).
  50 - 800 ℃ (HR High resistance type).
  50 - 500 ℃ (TF Thin film type).
  -150 – 200 ℃ (LT Low-middle temperature type).
- Atmosphere: in decompressed He gas.
- Thermocouple: C thermocouple (HT High temperature type).
  R thermocouple(TF Thin film type standard, HR High resistance type).
  K thermocouple (LT Low-middle temperature type).
- Data acquisition: Desktop personal computer (OS:Windows 7).

◎ Utilities(HT type)

- Space requirement: About 750mm W x 900mm D (for desk area of system).
  About 700mm W x 800mm D (for PC rack).
- System dimension: About 750mm W x 900mm D x About 750mm H
  (without projection).
- Weight of system: About 80 kg.

・Power: System：AC200V, 40 A（single phase +grounding one location）.
Data acquisition：AC 100 V, 10 A（AC outlet 2 locations）.

・Cooling water: Water pressure: 0.15 MPa, Flow rate: 5 L/min.
(City water or cooling water circulator)

【Price】

ZEM-5 HT High temperature type（Corresponding to 1200℃）.
9.8 million yen（Standard set, list price excluding tax, transportation charge and supervising fee by our engineer at customer's site).

ZEM-5 HR High resistance type（Capable of evaluating up to 10MΩ）
8.8 million yen（same as above）.

ZEM-5 TF Thin film type（Corresponding to thin film）.
9.2 million yen（same as above）.

ZEM-5 LT Low-middle temperature type（Temperature between -150℃ and 200℃）
8.8 million yen（same as above）.

【Applications】

・Evaluation of Seebeck coefficient and electric resistance of thermoelectric materials.
・Performance evaluation of Si series thermoelectric materials.
・Performance evaluation of oxide thermoelectric materials.
・Performance evaluation of thin film thermoelectric materials.

【Explanation of terms and image of system】

Refer to related materials.

【Exhibition】

Panel will be exhibited at ULVAC booth of "The 31st International & 10th European Conference on Thermoelectrics （ICT&ECT 2012）" in Denmark from July 9 to July 15, 2012.

【Sales plan in 2012】

Total quantity: 10 systems (domestic and overseas）.

【Contact information】

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【Explanation of terms】

1. Seebeck coefficient *S* (V K^{-1})

Thermoelectric effects such as Seebeck coefficient, Peltier effect and Thomson effect are widely known. Electromotive force will occur by applying temperature difference to joints of 2 different conductors. This is Seebeck effect.

If temperature difference is dT and potential difference is dV, Seebeck coefficient shall be obtained from the following formula.

$$S = \lim_{dT \to 0} \frac{dV}{dT}$$

2. Electric resistance ρ (Ω m)

Electric resistance is the index for capacity of non conducting electricity.

3. Figure of merit

3 parameters shall be required to improve performance of thermoelectric materials. (1) Occurrence of a big electromotive force（Voltage）(2)Acquisition of a big power (3)Advent of a big temperature difference.

Physical properties corresponding to the above three parameters are (1) Seebeck coefficient *S* (V K^{-1}), (2) Electric resistance ρ (Ω m), and (3) Thermal conductivity λ (W m^{-1} K^{-1}). A big Seebeck coefficient (absolute value), low electric resistance and low thermal conductivity shall be required to improve performance of thermoelectric materials. Figure of merit given by *Z* (K^{-1}) is described by the following formula.

$$Z = \frac{S^2}{\rho \lambda}$$

ZEM-5 is optimum for performance evaluation of thermoelectric materials since the above Seebeck coefficient *S* and electric resistance ρ can be measured at the same time.

Image of system

Seebeck Coefficient / Electric Resistance Measuring System ZEM-5 series