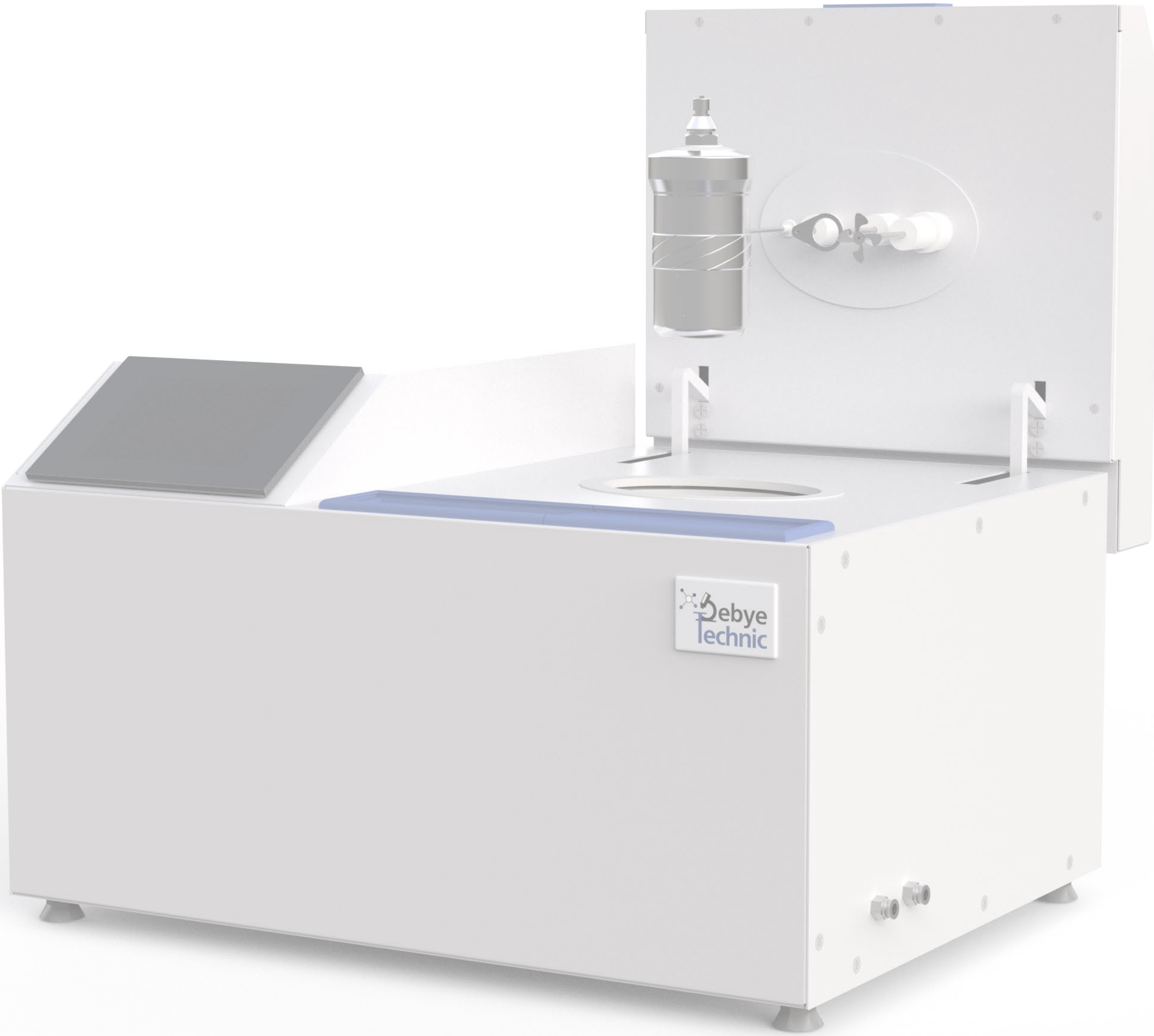
Debye Technic

CALORIMETER IC 210 PRESENTATION



ABOUT US

- Found in 2016 and Based in Ankara/TURKEY
- Multidisciplinary Team with R&D Department
  Sales Department
  After-Sales Service Department
- R&D Company Specialized on Laboratory Instruments
- 1 Utility Model for Solar Lighting Unit
- 1 Utility Model for Calorimeter
- 1 Patent Application for Calorimeter

CALORIMETER IC 210

Calorimeter is used for determining calorific value of solid and liquid samples. It can be used in a large variety of samples like COAL, COKE, WOOD, BIOFUEL, WASTE, EXPLOSIVE, OIL, FUEL and more.

Calorimeter IC 210 is a compact calorimeter working with an integrated water circulator.

FEATURES

- RSD Value <0.1%
- Temperature Sensitivity 0.0001°C
- 10- or 16-Min Analysis Duration
- Automated Water Filling Draining
- Automated Ignition
- Heating/Cooling Featured Water Circulator
- Application Notes for Different Methods
- Extended and Quick After-Sale Service
- Touch Screen Control
- Advanced PC Control:
  - Analysis Graphic Output
  - Automated Device Control
  - Auto Error Detection System
  - Excel/PDF Output
  - Analysis Recalculation
  - File Encryption
  - Service Authorizations (for Remote Service)

Additional Features

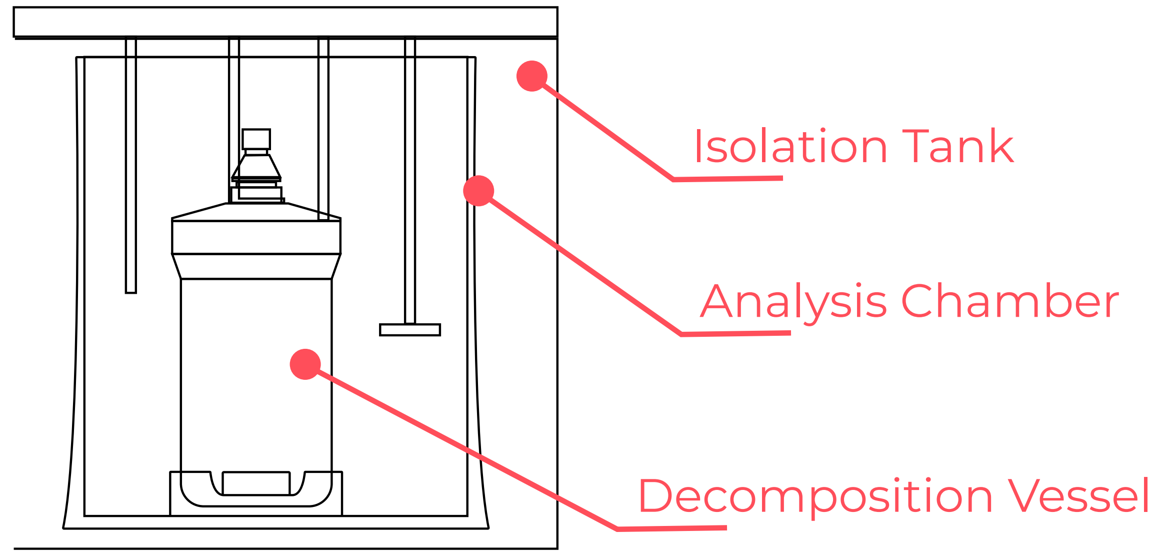
- Analysis Chamber has a Patent Utility Model
- Gravimetrically Detection of Hydrogen Content in Samples (Patent Application)
- User-Friendly PC Calorimeter Control Software
- Additional Recalculation Software
- Application Notes For Different Sample Types
- Excellent Service Support & Support Documents
- Education and Training Materials
- Spare Parts and Consumables

CALORIMETER ANALYSIS CHAMBER

(utility model)

Standard calorimeters has a metal analysis chamber (calorimeter can). Which leeds to the heat transfer from the chamber to the isolation tank. In the system of calorimeter analysis chamber needs to be as isolated as possible to accurately measure the calorific value of samples.

Calorimeter IC 210 has a plastic analysis chamber which has an utility model. With this system Calorimeter IC 210 is much more isolated from the surronding and this leads to more accurate results.



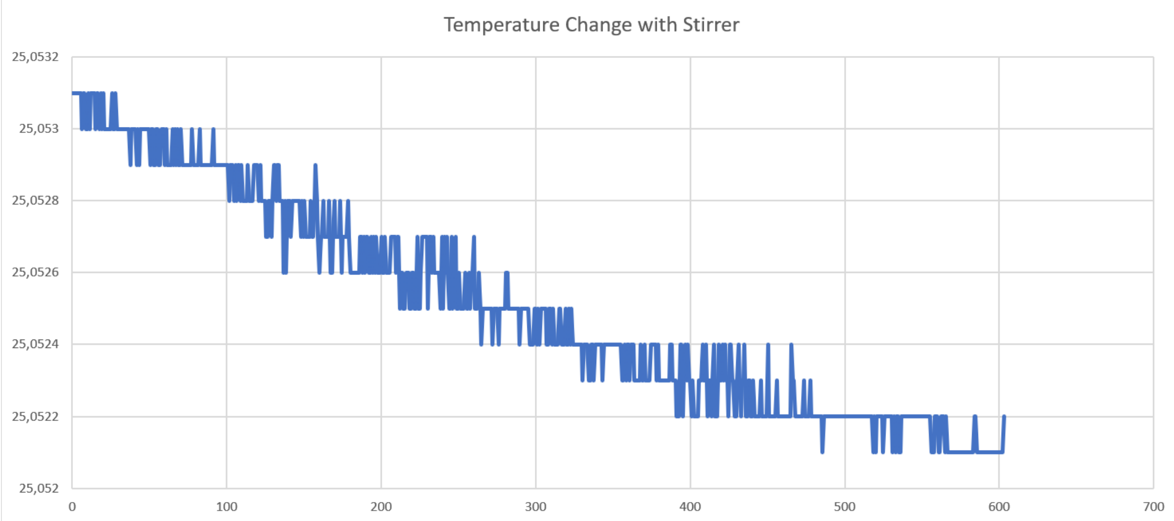
Advantages of Plastic Analysis Chamber

~100 times more isolated

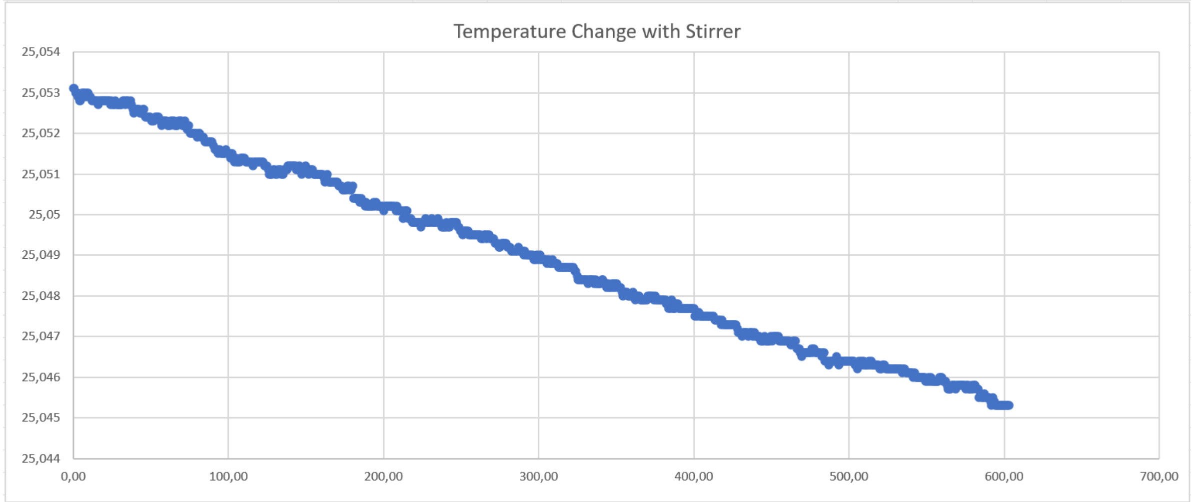
(Steel thermal conductivity coefficient ~14,4 W/mK, Plastic(used for chamber) thermal conductivity coefficient 0,0435 W/mK)

Good Temperature Stability

Temperature Change Over Time With Stirrer

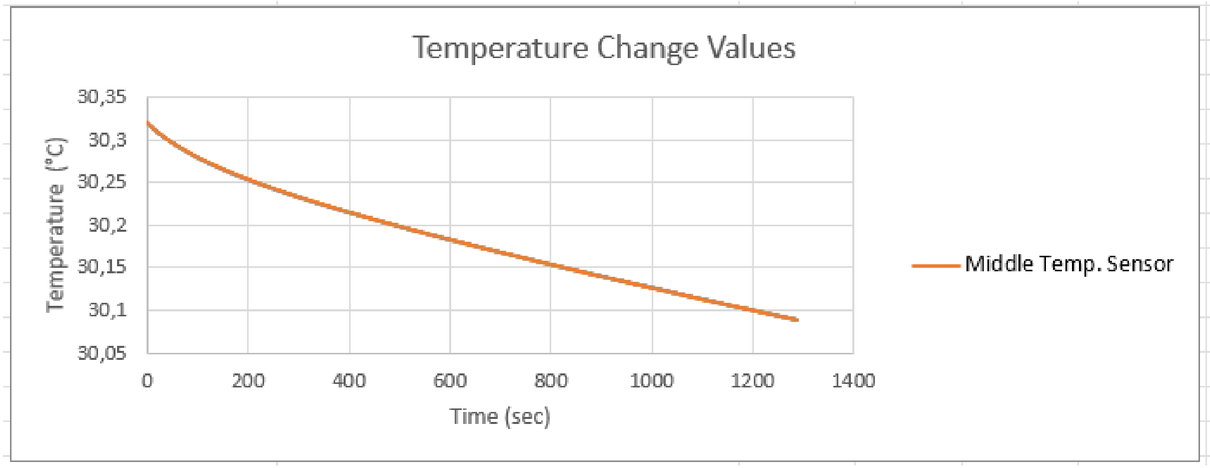


Middle Temp. Sensor

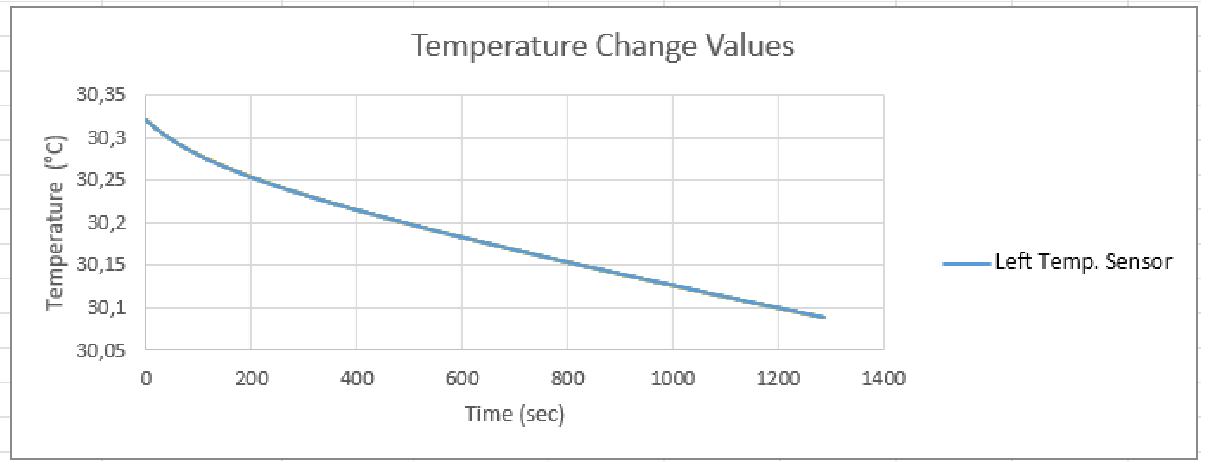


Left Temp. Sensor

Temperature Change Over Time Without Stirrer



Middle Temp. Sensor



Left Temp. Sensor

HYDROGEN MODUL OF CALORIMETER IC 210

(patent application)

Hydrogen content of samples has a direct effect on the calorific value. So, it is important to detect the hydrogen content to calculate the accurate calorific value of samples. As the known technic for the determination of hydrogen content, elemental analysis instruments (like CHNO) are used.

Disadvantages of Hydrogen Determination Instruments

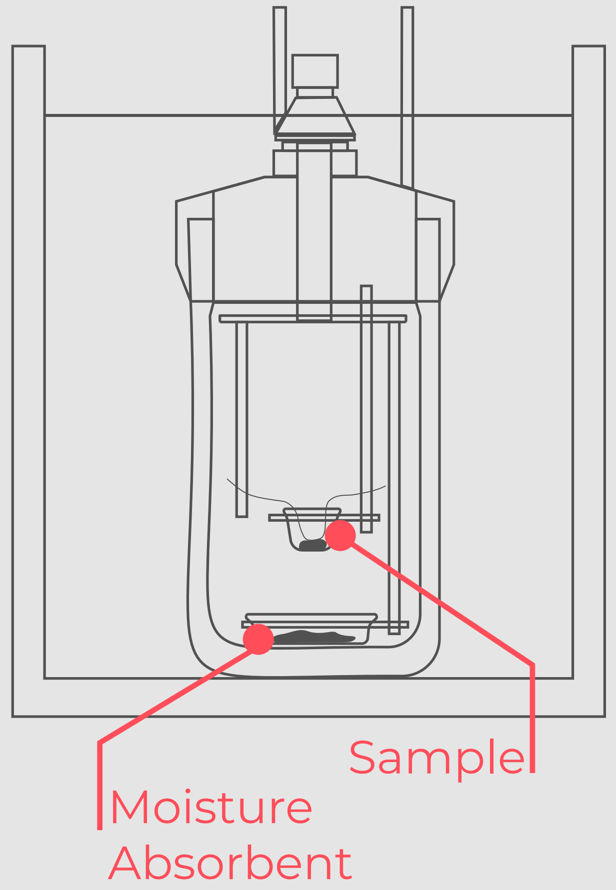
Operation Difficulties

Analysis with Low Weight

High Costs

Additional Instrument Need

Hydrogen Modul of Calorimeter IC210 is develloped by considering all the negative aspects of the current application.



How It Works

As the result of complete combustion, hydrogen content of the sample converts to water vapor. In this method, all of that water vapor is being absorbed with moisture absorbent chemicals. By using initial and final weight's of the chemical, water vapor absorbtion is calculated. Then the hydrogen content is determinated.

With Hydrogen Modul

Redesigned decomposition vessel

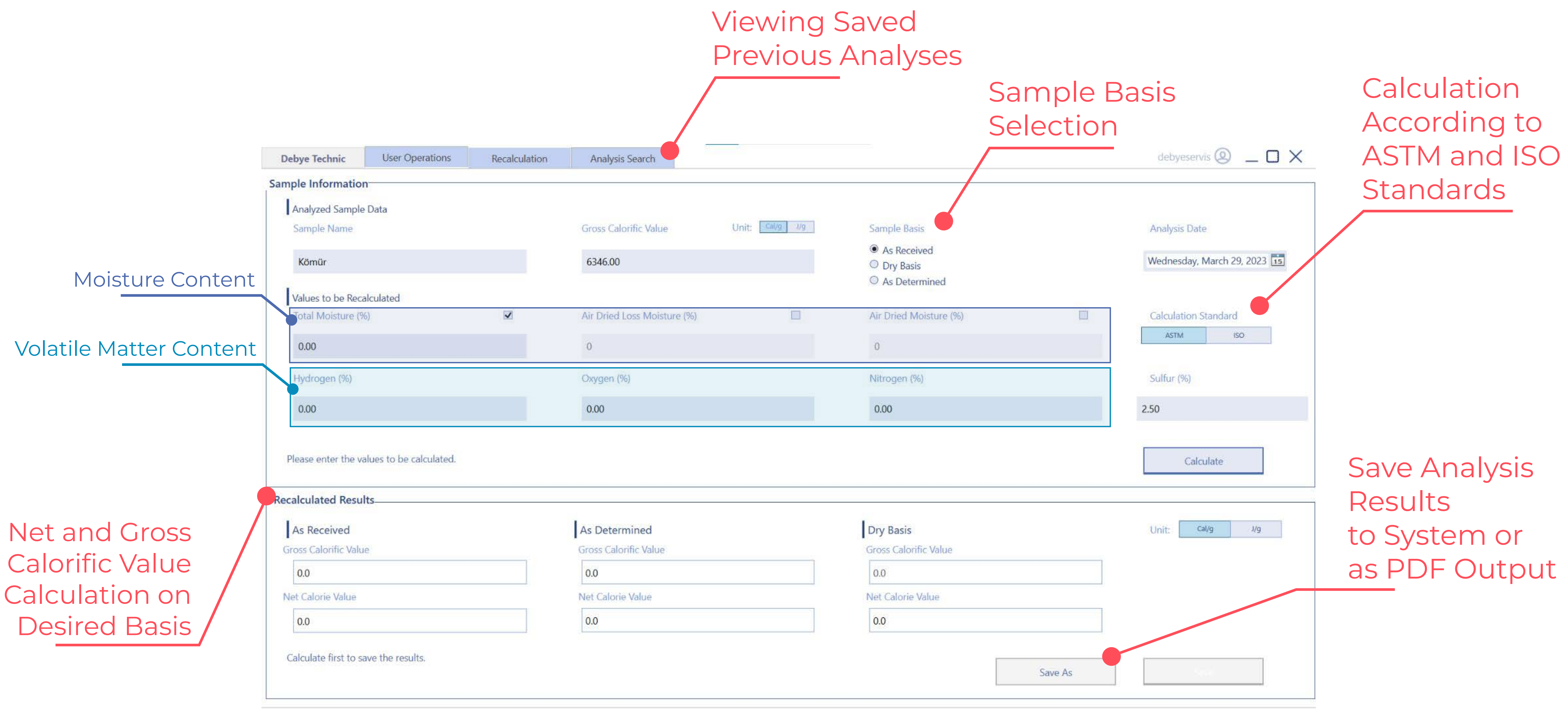
Reduced Costs

Easy Application

No other instrument is need apart calorimeter

RECALCULATION SOFTWARE

With Recalculation Software, all Calorimeter users (regardless of brand or model of the instrument) can recalculate calorific value results of analysed samples, according to ASTM and ISO standards.



Advantages of Recalculation Software

To recalculate analysis results:
Gross Calorific Value (raw value taken from the calorimeter instruments)
And the values of relevant parameters (like moisture, hydrogen...) is needed.

For coal analysis, users can calculate calorific value for different basis. (Like dry, as received or as determined)

Results of the calculation can be stored in application or taken as PDF output.

You can contact **info@debyetechnic.com** for **1 week demo** of the recalculation software.

ANALYSIS WITH CALORIMETER IC 210

As a R&D company, we value sample diversity analysed with calorimeter. And we develop new methods by analysis of different samples.

Certified Reference Material

Used as calibration and verification standard material for calorimeters.

For Calorimeter IC 210, TÜBİTAK UME CRM 1504 Benzoic Acids are being used. Established a highly succesfull relation as for repeatability and accuracy.

ASTM D5865

Most analysed material with calorimeter.

Variety of coal samples with high or low calorific value and coke samples has been studied with Calorimeter IC 210.

Creating application notes about all aspects of coal analysis not just for calorific value analysis to inform our users. These applications includes; how to prepare the coal sample to how to report the results.

3. ABBREVIATION LIST

e_1 (J)	fuse correction
e_2 (J)	nictric acid correction
e_3 (J)	sulfur correction
e_4 (J)	combustion aid correction
H_d	hydrogen fraction of dry basis coal
M_{ad}	moisture as determined
M_{ar}	total moisture (moisture of as received)
N_d	nitrogen fraction of dry basis of coal
O_d	oxygen fraction of dry basis of coal
Q_{gh}	energy associated with the change in colume of the gaseous phase of coal
Q_h	energy associated with the heat of caporization of warer that originates from the hydrogen content of the coal
Q_{mar}	energy associated with the moisture of content of as received basis of coal
$Q_{ad,net}$	net calorific value of as determined basis of coal
$Q_{ad,gross}$	gross calorific value of as determined basis of coal
$Q_{d,net}$	net calorific value of dry basis of coal
$Q_{d,gross}$	gross calorific value of dry basis of coal
$Q_{ar,net}$	net calorific value of as received basis of coal
$Q_{ar,gross}$	gross calorific value of as received basis of coal

4. CALCULATION (ASTM D5865)

4.1. Gross Calorific Value (Constant volume, Isoperibol)

With the IC 210 Isoperibol Calorimeter, analysis of as received basis (original) coal, as determined basis of coal, or dry basis of coal can be analyzed in accordance with ASTM D5865 standard. Depending base of the coal sample used, the gross calorific value is calculated as a result of the analysis. The gross calorific value can also be calculated by the system on other bases desired. While analyzing on as received basis, the gross calorific values of as determined basis and dry basis coal can be calculated by the system by entering the humidity values specified in 4.1.3 and 4.1.4. When analyzing coal on as determined basis, the moisture value specified in 4.1.4 can be entered to calculate the gross calorific value of dry basis.

The following formulas are the conversion formulas used when calculating analysis results with IC 210 Isoperibol Calorimeter. Detailed information can be found on the calculation of the gross calorific value of coal in the application note *'Gross Calorific Value of Coal Samples'*.

4.1.1. Gross Calorific Value

Q_{gross}(J/g) = [(Heat Capacity*ΔT)-e_1-e_2 e_3] /m

4.1.2. Gross Calorific Value of As Recevied Basis of Coal

$Q_{ar,gross}$= $Q_{d,gross}$*(100-M_{ar})/100

4.1.3. Gross Calorific Value of As Determined Basis of Coal

$Q_{ad,gross}$= $Q_{ar,gross}$* (100 – M_{ad}) /(100-M_{ar})

4.1.4. Gross Calorific Value of Dry Basis of Coal

$Q_{d,gross}$= $Q_{ad,gross}$* (100/(100 – M_{ad}))

4.2 Net Calorific Value (Constant Pressure, Isoperibol Calorimeter)

After the analysis of the gross calorific value of coal with IC 210 Isoperibol Calorimeter in accordance with the ASTM D5865 standard, the net calorific value of as received, as determined and dry basis of coal can be calculated by the system. When the net calorific value of coal is calculated by using the gross calorific value, total moisture, hydrogen, oxygen, nitrogen fractions should be known. By using a moisture analyzer instrument, as received basis of coal is dried to dry basis of coal. Also, the result obtained from the moisture analyzer refers to the

Calorimeter IC 210 Application Note *Page 2*

Gross and Net Calorific Value Application Note

ANALYSIS WITH CALORIMETER IC 210

Biofuel

Applications of biofuels which has an increase of usage.
Studied samples will be detailed with examples: UME BIOFMET CRM 02 & 03.

Other biofuel studied; chicken manure, wood chips, nutshell, tea waste,...

Increase in the use of biofuels, greatly reduces the damage done to the environment. Highly energetic biofuels are available and use of these fuels, which have very low sulfur emissions, should be increased.

Calorific Value Results (As Received Basis)

UME BIOFMET CRM 02: Wood Pellet Powder

Sample	J/g	Cal/g
UME BIOFMET CRM 02	18654.5	4455.6
UME BIOFMET CRM 02	18711.3	4469.1
UME BIOFMET CRM 02	18713.0	4469.5
UME BIOFMET CRM 02	18662.4	4457.4
UME BIOFMET CRM 02	18623.9	4448.2
Average	**18673.0**	**4459.96**

UME BIOFMET CRM 03: Wood Pellet

Sample	J/g	Cal/g
UME BIOFMET CRM 03	18789.9	4487.9
UME BIOFMET CRM 03	18808.4	4492.3
UME BIOFMET CRM 03	18847.2	4501.6
UME BIOFMET CRM 03	18836.7	4499.1
UME BIOFMET CRM 03	18901.1	4514.4
Average	**18836.6**	**4499.06**

Analysis of
UME BIOFMET CRM 02: Wood Pellet Powder

Before Analysis

After Analysis

Analysis of
UME BIOFMET CRM 03: Wood Pellet

Before Analysis

After Analysis

WHAT WE CAN DO MORE?

CRM Sample Tests (Scientific Studies)

Decomposition Vessel Design Special for Variety of Samples

Improvement of Systems Regarding Sample and Process

THANK YOU
FOR YOUR ATTENTION

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www.debyetechnic.com

info@debyetechnic.com

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DEBYE TECHNIC

(0312) 485 40 42

(0312) 485 40 42