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THE *INTERTECH* EQUIPMENT FOR LABORATORY ANALYSIS AND SCIENTIFIC RESEARCH

Intertech is an American corporation which has been supplying instruments for laboratory analysis and scientific research to Ukraine for 15 years. The Corporation is the exclusive dealer of Thermo Fisher Scientific, TA Instruments, and some other companies. Intertech offers instrumentation for elemental and molecular analysis, surface and nanostructure investigation, thermal analysis, sample preparation and provides certified service and methodological support for supplied equipment. There are two service centers in Ukraine, in Kyiv and in Donetsk. More than 100 Ukrainian enterprises use instrumentation supplied by Intertech Corporation including metallurgical, machine-building, chemical, and food industries, academic and research institutions, medical institutions, and environmental inspectorates.

Key words: Thermo Fisher Scientific, Fritsch, TA Instruments, CEM, analytical equipment, sample preparation, thermal analysis.

Intertech is an American corporation supplying equipment for chemical analysis, sample preparation, particle-size distribution tests, thermal analysis, and surface analysis. It is headquartered in Atkinson (Massachusetts, USA). The Company's activities in the CIS countries are organized by representative offices, each of which is responsible for specific territory. The representative office in Ukraine was opened in 1997. Currently, it includes two offices in the cities of Kyiv and Donetsk. The main business direction is representing the interests of *Thermo Fisher Scientific Inc*., a leading manufacturer of analytical tools and equipment. Our company offers a full range of devices made by this manufacturer for elemental analysis of solutions, including:

- Atomic absorption spectrometers;
- Spectrometers with inductively coupled plasma (emission and mass spectrometers);

Also, it offers the following equipment for molecular analysis:

- Spectrophotometers of UV and visible regions;
- *Nicolet* IR Fourier-transform spectrometers;
- NIR analyzers;
- Raman spectrometers;
- IR microscopes

In addition to the above mentioned equipment, the Company offers a variety of instruments for thermal analysis, including:

- Differential scanning calorimeters;
- Thermo-gravimetric analyzers;
- Instruments for rheological studies; and
- Dynamic mechanical analyzers.

Among the range of Corporation's products, there are also equipment for studying the surfaces and nanostructures. Brief information on this equipment is given below.

ELEMENTAL ANALYSIS

In 2013, *Thermo Fisher Scientific* released a new series of emission spectrometers with inductively coupled plasma **iCAP 7000** (Fig. 1). It can be used for quantification of virtually all the peri-

odic system elements in a wide range of concentrations (from fractions of μg/l and more).

The iCAP 7000 spectrometers are improved and upgraded version of iCAP 6000 spectrometer which has become the most popular device with inductively coupled plasma in the world. The main advantages of iCAP 7000 are as follows:

- Simultaneous multi-element analysis (up to 70 elements) in a wide range of concentrations;
- Identification of matrix alloy components with accuracy comparable to the accuracy of classical chemical analysis methods (RMS <0.1 rel. %);
- High sensitivity: identification of 70 elements in solutions with maximum detection limit of 1 μg/l and identification of impurities in solid samples at the level of ppm or lower;
- Linear calibration curves within the range of 4-6 orders of magnitude;
- Analysis of metals and alloys without dissolution using an attachable spark sampler;
- Ability to analyze solid samples with ablation attachments;
- Reduction of analysis time with the use of improved sample injection system;
- New *Qtegra Intelligent Scientific Data Solution* software.

For the laboratories who are interested in identifying lower concentrations, as well as isotopic composition, *Thermo Fisher Scientific* offers new mass spectrometers with inductively coupled plasma **iCAP Q** (Fig. 2). The device has some innovative features as a result of which its performance characteristics are the best in the market. Among these advantages, there are the following ones:

- The highest signal/background ratio and the widest range of masses which can be identified;
- Unmatched promptness and simplicity of routine operations;
- The instrument and performance check are run automatically by pressing one button;
- Flexible configuration options for advanced users;
- Availability of completing units with a wide range of configuration options;
- Compact separate burner block and metallic ventilating communications minimize the device contamination and provide the best protection of electronics during the analysis of radioactive materials.

MOLECULAR ANALYSIS

Nicolet Corporation (Madison, Wisconsin, USA) has been manufacturing FTIR spectrometers since 1960s. Nowadays, it is a part of the *Thermo Fisher Scientific* global holding. The cutting edge **iS50 *Nicolet*** FTIR spectrometers (Fig. 3) are designed for professionals of academic research centers, universities, and leading industrial laboratories. The spectrometers have an extremely wide

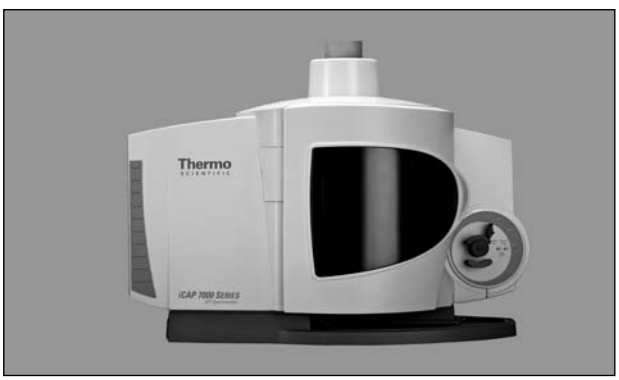

Fig. 1. iCAP 7000 Series emission spectrometers with inductively coupled plasma

Fig. 2. iCAP Q Series mass spectrometers with inductively coupled plasma

Fig. 3. iS50 FTIR spectrometer

Fig. 4. iN10 *Nicolet* IR microscope

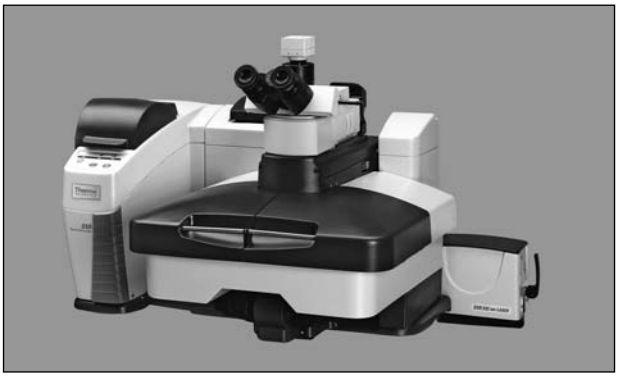

Fig. 5. Confocal microscope DXR Raman microscope

range of configuration options and can be equipped for operation in a wide spectral range, from the visible to the far infrared region. Depending on the purpose of their use they can be equipped with detectors of various sensitivity and speed, optical systems with a gilded or aluminum coating, as well as with accessories. The iS50 *Nicolet* device is remarkable for compatibility with large number of peripherals for implementing sophisticated analytical techniques (IR microscope, integrating sphere, fiber sensor) and with other analytical instruments (gas chromatograph, thermoanalyzer, Raman module, dual-channel scanning module, and Step Scan). In terms of high performance and simplicity, today, iS50 *Nicolet* FTIR spectrometer is unrivalled in the market.

The iS50 *Nicolet* is an optimal multifunctional complex for material analysis, pharmaceutical analysis, polymer research, and forensic examination.

For studying the enclaves, defects, and microzones of a size of 5 microns and higher in nonmetallic materials the FTIR spectrometer is combined with *Nicolet Continuμm* IR microscope. This allows the researchers to make non-destructive surface microanalysis of samples having enclaves or complex multilayer structure. In this case there is a possibility to carry out sample visual inspection, documenting and registration of IR spectrum and building of complex profiles and maps characterizing the distribution of impurities or functional groups on the sample surface. The unique high-speed IR microscope coupled with Fourier spectrometer in a single body is available under the brand **Nicolet iN10** (Fig. 4).

The dispersive Raman spectrometers ***DXR Smart Raman*** and confocal Raman microscopes ***DXR Raman*** **microscope** (Fig. 5) are designed for modern multi-research laboratories. The Raman spectrometers are widely used in forensic science, pharmaceutical science, laboratories for research and development of new materials, and for analysis of polymers, minerals, gems, and nano-carbon materials. The *DXR Smart Raman* and *DXR Raman* microscopes are equipped with automatic testing and configuration systems that ensure easy operation and high accuracy and reproducibility of analysis.

The ultraviolet/visible (UV/Vis) spectrophotometers manufactured by *Thermo Scientific* (formerly *Unicam*) have high optical performance, are versatile and reliable. The ***Evolution*** **201/220/260**

Bio spectrophotometers (Fig. 6) are the best combination of low price and high quality for a wide range of budget laboratories. The ***Evolution* 300/600** research spectrometers (Fig. 7) are characterized by a wide range of attachments (reflection, fiber optics, temperature control) and flexible configuration for scientific purposes.

Also, it is necessary to mention the *Thermo Scientific* Nano Drop products. This is unique equipment for research and diagnostic laboratories. Such products as ***NanoDrop Lite*** (Fig. 8), *NanoDrop* 2000, and *NanoDrop* 8000 represent a new generation of spectrophotometers for measuring concentration and purity of nucleic acids, quantitative analysis of proteins, conjugates, and metalloproteins. The product line is completed with ***Nano Drop* 3300 fluorospectrometer** for measuring a wide spectrum of fluorescent dyes.

Among the advantages of *NanoDrop* products there are the following ones:

1) All the devices use the effect of surface tension to hold the sample, which eliminates the need for cuvettes and capillaries. This significantly reduces time of measurements and allows the researchers to use extremely small sample volume (0.5 μl) for analysis (at the same time, the devices can be used for work with standard cuvettes);

2) Promptness and convenience of measurement procedure: it requires a few seconds to delete the previous sample and to measure the next one;

3) Automatic selection of desired optical path length depending on concentration of test substance (contrary to the method with the use of cuvettes, in this case there is no need to have very precise initial information on concentration of analyte in the sample);

4) Remarkably small dimensions of device.

Fig. 6. UV/Vis spectrophotometer, series *Evolution* 201/220/260 Bio

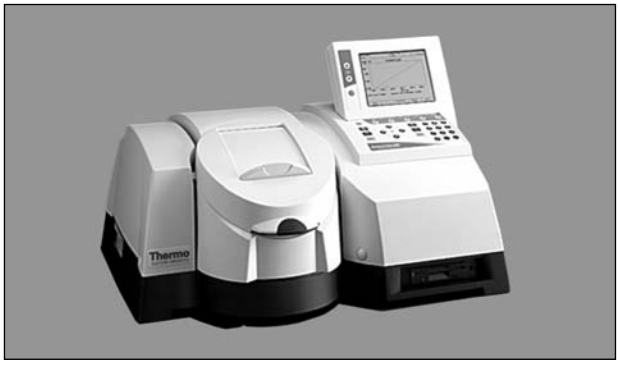

Fig. 7. UV/Vis spectrophotometer, series *Evolution* 300/600

Fig. 8. *NanoDrop Lite* spectrophotometer

THERMAL ANALYSIS

Nowadays, *TA Instruments,* an American corporation, is the absolute world leader in the development and sales of analytical instruments for thermal analysis. Historically, the company was established as the Instrument Division of *DuPont*, a well-known corporation specialized in the development and production of new materials. The corporation is constantly engaged in research and development activities and is funding several groups of developers of devices and software, who implement new analysis techniques and technologies

Fig. 9. *Nano* calorimeters

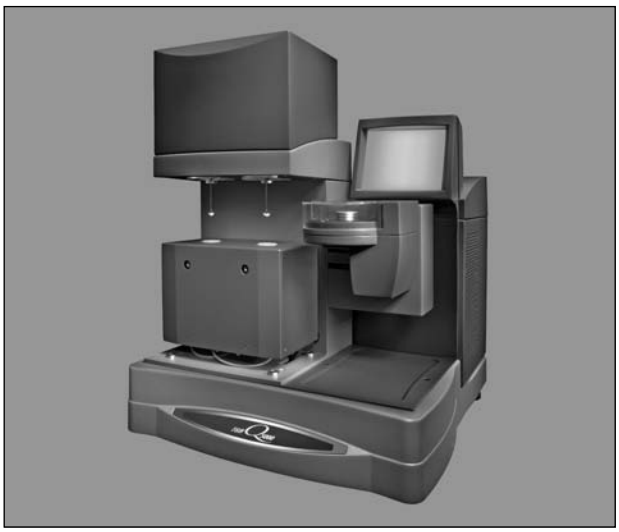

Fig. 10. Q5000SA thermo-gravimetric analyzer

that improve the quality of analytical data, as well as the accuracy and reproducibility of analysis.

The differential scanning calorimeters manufactured by *TA Instruments* are presented by the latest ***Discovery*** **DSC** calorimeter and models of the series Q-Q20, Q20P, Q20A, and Q2000. The instruments for routine analysis are as follows: low-level calorimeter Q20, automated calorimeter Q20A, and calorimeter Q20P for operation under high pressure. The Q2000 calorimeter is designed for research activities. *Discovery* DSC is a high-level research calorimeter with a uniquely stable baseline. The *Nano* calorimeters of (Fig. 9) are developed specifically for the analysis of biological samples. The series includes differential scanning calorimeter ***Nano*****DSC** and isothermal titration calorimeter ***Nano*****ITC**.

The thermo-gravimetric analyzers manufactured by ***TA Instruments*** are the state-of-the-art appliances with a high degree of automation, flexible configuration, and ease of use. The product range comprises classical analyzers TGA Q500 and Q50; *Discovery* TGA; sorption-gravimetric analyzer Q5000SA (Fig. 10); VTI-SA; and high pressure thermo-gravimetric analyzer TGAHP. In addition, the company offers SDT Q600, a model of synchronous thermo-analyzer (TGA/DSC/DTA).

The thermo-mechanical analyzers Q400 and Q400EM allow the researchers to very accurately measure the changing linear dimensions of sample at a given temperature, load time, and atmosphere with optional modulation of temperature and load.

The dynamic mechanical analyzers **Q800** (Fig. 11) and **RSA-G2** are research equipment capable of addressing the traditional DMA problems related to measuring modulus of elasticity, mechanical losses, tangent of mechanical loss angle, complex viscosity, and other characteristics of materials depending on temperature, time, and parameters of strain.

The ***TA Instruments*** rheometers are used to determine viscosity and elastic properties of both liquid and solid samples. The rheometers of new *Discovery* DHR series with magnetic bearings are characterized by minimal inertia. A wide range of attachments, geometries, and special options (interfacial geometry, high-pressure cell for bitumen, UV polymerization, and others) makes possible to use the DHR-1, DHR-2, and DHR-3 rheometers for both the research purposes and the industrial applications.

TAM **isothermal calorimeters** are versatile and sensitive instruments to study a variety of processes involving release or absorption of heat. They

can be used to study virtually any physical or chemical changes in material (phase transition, oxidation, aging, sorption, etc.).

The analyzers of thermo-physical properties are a new direction vigorously developed by *TA Instruments*. To determine the thermal diffusivity of liquid and solid materials *TA Instruments* offers **DTC- 25, DTC-300** and ***Discovery Flash*** analyzers using the methods of flash and heat flux. Depending on method and thermostat used the analyzers can operate within the range from –150 to 2800 °C with atmosphere monitoring and various automation levels.

The ***TA Instruments*** **dilatometers** are used to study the properties, to control processes and quality of materials within the temperature range from –160 to +2800 °C. The versatile dilatometers have a horizontal design with standard, differential or dual-channel circuit. The vertical analyzers are designed for high-temperature oxide synthesis and powder metallurgy.

At the end of 2013, the ***TA Instruments*** Corporation has introduced a complete line of new instruments for measuring the rheological and physical properties of plastics, rubber, and rubber compounds at all stages of production. New systems for testing rubbers include RPA flow analyzer, rheometer with moving punch, Mooney viscometer, automated density tester, and automated hardness testing instrument.

All the *TA Instruments* systems for testing of rubber compounds and rubber are manufactured in compliance with the strict standards and cutting-edge measurement technologies to ensure obtaining the most accurate, reliable, and reproducible data. The automation systems make it possible to maximize performance of laboratory without engaging laboratory operators. The analyzers meet the requirements of ASTM, DIN, ISO and other standards. This makes these instruments ideal for quality control, analytical and research tasks.

STUDY OF SURFACES AND NANOSTRUCTURES

The Company offers equipment for studying the surface and nanostructures (tribological, electri-

Fig. 11. Q800 dynamic mechanical analyzer

Fig. 12. *K-Alpha* XPS

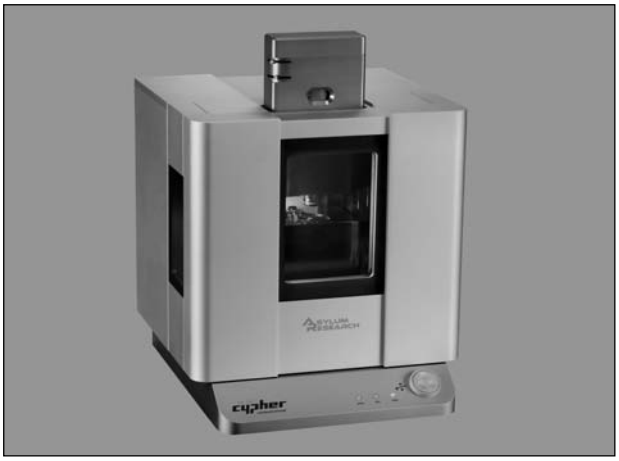

Fig. 13. *Asylum Research* atomic force microscopy

cal, acoustic, and mechanical properties), as well as electron-probe instruments for surface analysis, NDT of coating structure, mapping of impurity distribution, ion cleaning, annealing, and heating. The instruments allow for the use of qualitative and quantitative analytical methods using X-ray photoelectron spectroscopy, scattered ions, Auger spectroscopy, and others.

K-ALPHA is a fully integrated X-ray photoelectron spectrometer (XPS), the most compact and user friendly instrument (Fig. 12) which provides high performance at a reasonable price. All the processes are automated; all the operations are done without any user intervention (except for sample loading). The system has proven itself as a powerful tool for chemical and phase analysis of surfaces and coatings.

The ***Asylum Research*** **scanning probe microscopes** (Fig. 13) are research systems from the industry leader, which combine unsurpassed resolution in all the operation modes and innovative design of microscopes with a wide range of options for advanced users. The plenty of probe techniques allows the researchers to obtain topographical data (defects), electrical and magnetic properties of surface at the atomic level, the force curves at a given point and their mapping, etc.

CONCLUSION

Intertech Corporation offers a wide range of research equipment for different tasks. All the equipment supplied is warranted. The installation of equipment and basic personnel training are performed by certified engineers who have been trained at the factory and are employed by *Intertech* (in Ukraine, there are two service centers, in Kyiv and in Donetsk). The corporation has its methodological service which provides assistance in the development and implementation of analytical methods.

С.М. Романов

ОБЛАДНАННЯ КОМПАНІЇ INTERTECH ДЛЯ ЛАБОРАТОРНОГО АНАЛІЗУ ТА НАУКОВИХ ДОСЛІДЖЕНЬ

Американська компанія Intertech уже 15 років поставляє обладнання для лабораторного аналізу й наукових досліджень в Україні. Компанія є ексклюзивним представником американського концерну Thermo Fisher Scientific, TA Instruments і ряду інших компаній. Компанія пропонує обладнання для елементного й молекулярного аналізу, дослідження поверхні й наноструктур, термоаналізу, пробопідготовки, а також забезпечує сертифіковану сервісну й методичну підтримку техніки, що поставляється. В Україні діє два сервісних центри — у Києві й Донецьку. Більше 100 підприємств України є користувачами обладнання, що поставляє компанія Intertech, серед яких підприємства металургійної, машинобудівної, хімічної й харчової галузей, навчальні й науково-дослідні інститути, медичні установи й екологічні інспекції.

Ключові слова: Thermo Fisher Scientific, Fritsch, TA Instruments, CEM, аналітичне обладнання, пробопідготовка, термоаналіз.

С.Н. Романов

ОБОРУДОВАНИЕ КОМПАНИИ INTERTECH ДЛЯ ЛАБОРАТОРНОГО АНАЛИЗА И НАУЧНЫХ ИССЛЕДОВАНИЙ

Американская компания Intertech уже 15 лет поставляет оборудование для лабораторного анализа и научных исследований в Украине. Компания является эксклюзивным представителем американского концерна Thermo Fisher Scientific, TA Instruments и ряда других компаний. Компания предлагает оборудование для элементного и молекулярного анализа, исследования поверхности и наноструктур, термоанализа, пробоподготовки, а также обеспечивает сертифицированную сервисную и методическую поддержку поставляемой техники. В Украине действует два сервисных центра — в Киеве и Донецке. Более 100 предприятий Украины являются пользователями оборудования, поставляемого компанией Intertech, среди которых предприятия металлургической, машиностроительной, химической и пищевой отраслей, учебные и научно-исследовательские институты, медицинские учреждения и экологические инспекции.

Ключевые слова: Thermo Fisher Scientific, Fritsch, TA Instruments, CEM, аналитическое оборудование, пробоподготовка, термоанализ.

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