



BET SPECIFIC SURFACE AREA & PORE SIZE ANALYZER

BELSORP MINI X

microtrac.com/pl/produkty/pomiar-adsorpcji-gazow/powierzchnia-wlasciwa-i-wielkosc-porow/belsorp-mini-x/

BELSORP MINI X

BET SPECIFIC SURFACE AREA & PORE SIZE ANALYZER

For simple, fast and highly accurate characterization of porous materials

World class repeatability. Microtrac's BELSORP MINI X's outstanding features result in world class repeatability, with significantly reduced measurement time. The MINI X is equipped with up to 4 sample measurement ports and new high-throughput functions including multi-device control.

The BELSORP MINI X is meticulously designed to measure specific surface area, pore size distribution and pore volume with extreme accuracy. Equipped with dedicated pressure sensors on each sample measuring port and a dedicated port for saturated vapor pressure, it enables completely independent simultaneous measurements.

The new measurement software improves user productivity by streamlining measurement procedures with in software step-by-step instructions, displaying the measurement progress and sending the measurement results via e-mail. Depending on your sample throughput, 3-port and 4-port models are offered.

The new analysis software (BELMASTER™) enables structural evaluation of a wider range of materials than ever before.



INDEPENDENT MEASUREMENT PORTS

Up to four specimens can be measured simultaneously, enabling the measurement times for multiple samples to be shortened significantly.

BELSORP MINI X

WORLD CLASS LEVELS OF REPRODUCIBILITY

- Up to four independent measurement ports and one dedicated port for saturated vapor pressure measurements
- Smallest & lightest in the world
- Unbeatable reproducibility by patented AFSM™
- Gas adsorption isotherm & NET adsorption measurement through AFSM™2 without the need of He-gas
- Multiple measurement methods: high-precision, multi-sample, and quick BET modes
- Dedicated pressure transducer for each port
- Simultaneous control of up to 20 measurement ports via multi-device control (5 units)
- Short measurement time with GDO
- IoT: process monitoring via e-mail notification system
- Optional micropore analysis by molecular probe method
- Optional FDA 21 CFR Part 11 compliance

BELSORP MINI X

KLUCZOWE CECHY

BET specific surface areas from $0.01 \text{ m}^2/\text{g} \sim (\text{N}_2)$ and pore size distribution from $0.7 \sim 500 \text{ nm}$ (option: $0.35 \sim 500 \text{ nm}$ by molecular probe method).

SIMULTANEOUS MEASUREMENT OF MULTIPLE SAMPLES

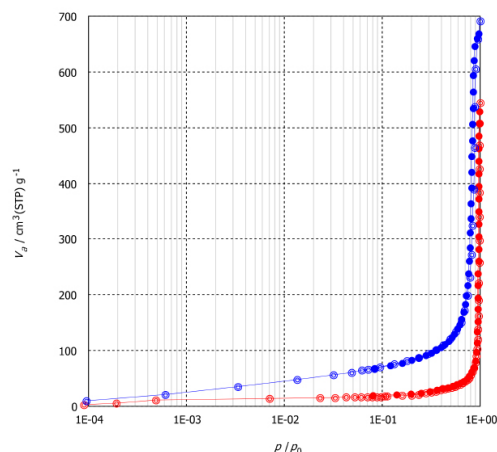
Up to 4 specimens can be measured simultaneously, enabling the measurement times for multiple samples to be shortened significantly.

MULTIPLE MEASUREMENT OPTIONS

This instrument brings together highly accurate measurements with several high throughput modes (e.g. Quick BET mode, Gas Dosing Optimization). It can be used flexibly depending on customer needs.

EASE OF USE

The BELSORP MINI X is a fully automatic measurement system. Simple Mode enables accurate measurements with minimal sample information; detailed configurations can be set in Professional mode.

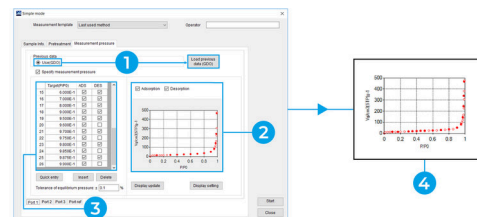


BELSORP MINI X

MEASUREMENT METHODS

GAS DOSING OPTIMIZATION (GDO)

Simple Mode includes the Gas Dosing Optimization (GDO) option, which automatically calculates the optimal gas dosing amount from previous measurement results. With this function, the measurement set points can be reliably obtained and the measurement times can be reduced significantly.



INNOVATIVE FREE SPACE MEASUREMENT FOR HIGHEST ACCURACY (AFSM™)

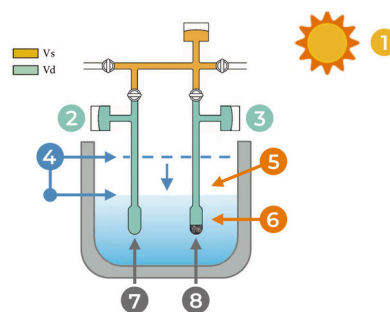
With AFSM™, the level control of liquid coolant (e.g. liquid nitrogen or argon) is not necessary anymore. Instead, we have adopted our groundbreaking, continuous free space measurement method, the patented Advanced Free Space Measurement (AFSM™).

This method has achieved highest reproducibility by using a reference cell (empty sample cell; same type of sample cell used for measurement) to follow second-to-second changes of free space. Since the change of free space is equal in the sample and reference cells under the same environmental conditions, the free space change can be continuously followed by the pressure change of the reference cell.

Free space fluctuations caused by environmental factors can be considered:

- | LN₂ level changes
- | Atmospheric temperature / pressure changes
- | Temperature changes of coolant due to oxygen dissolution

With this technique, environmental factors can be taken into account that were not considered before.

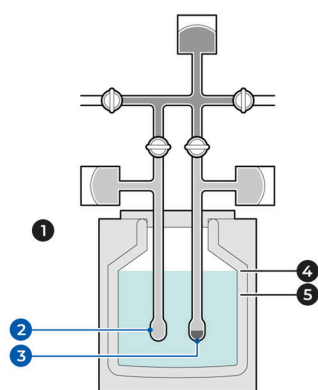


BELSORP MINI X

HELIUM-FREE MEASUREMENT & PRETREATMENT

ADSORPTION MEASUREMENT WITHOUT USING HELIUM GAS (AFSM™2)

First, free space measurement for a blank sample cell and a blank reference cell is performed with the adsorptive gas at the appropriate adsorption temperature. Then adsorption measurement can be achieved by utilizing both cells without helium gas. As free space changes for both cells are the same, measurement results can be obtained in a shorter time, without keeping the coolant level constant between blank and adsorption measurements.



COMPACT & LIGHTWEIGHT

Through complete optimization and rationalization of the materials, we succeeded in reducing the device size and weight.

OPTIONAL PRETREATMENT OF SAMPLES AT MEASUREMENT PORT

For accurate adsorption measurement, samples are usually pretreated by vacuum under heat to remove adsorbed gas and/or water molecules without affecting sample structure. Pretreatment can be performed externally using BELPREP VAC II or VAC III to increase throughput, or directly at the BELSORP MINI X measurement port using a heater. Avoiding transfer is important for sensitive, e.g. hydrophilic, samples.

DATA ANALYSIS

BELMASTER enables display of adsorption / desorption isotherms; BET specific surface areas; pore volumes by t-plot or αS method; mesopore analysis by DH and BJH; micropore analysis by HK or SF; and optional GCMC / NLDFT analysis.

MORE BELCONTROL FEATURES

- | Overlay adsorption / desorption isotherms and compare data between ports during measurement
- | Store pressures, temperatures and valve actuations in trend data
- | System check function for diagnosing instrument status
- | E-mail notifications of measurement status and results
- | Interactive program in Japanese or English
- | Step-by-step instructions and extensive help functions

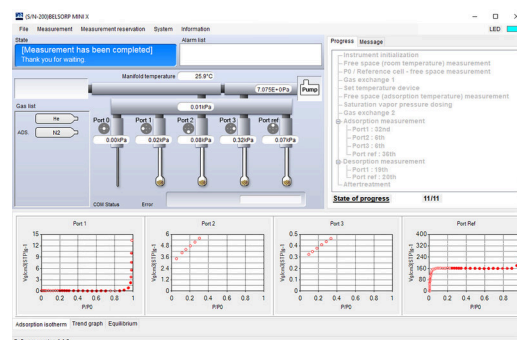
BELSORP MINI X

BELCONTROL: NEW OPERATION SOFTWARE

The versatility of BELSORP equipment is complemented by BELCONTROL, the intuitive, user-friendly operation software. It guides the user step-by-step through setup of analysis conditions, measurements, filling the liquid nitrogen or other bath, replacement of gas cylinders and degassing steps. It is designed to make the instrument accessible to inexperienced users.

For inexperienced users or measurements of unknown samples, BELCONTROL only requires basic sample information (name, mass, etc.), pretreatment conditions (if not performed externally) and measurement range.

Professional Mode permits detailed control of dosing settings, equilibrium criteria, leak-test options and other measurement configurations. Simple Mode reduces setup requirements; when a comparable prior isotherm is available, GDO can shorten measurement time.



Feature	Availability	BELCONTROL
Quick BET	tak	Multi-point BET surface area in less than 20 minutes
Helium-Free Measurement	tak	AFSM™2 enables He-free measurements with unmatched accuracy
Adsorption Kinetics	opcjonalnie	Rate of adsorption measurements for diffusion analysis

OPERATION SOFTWARE

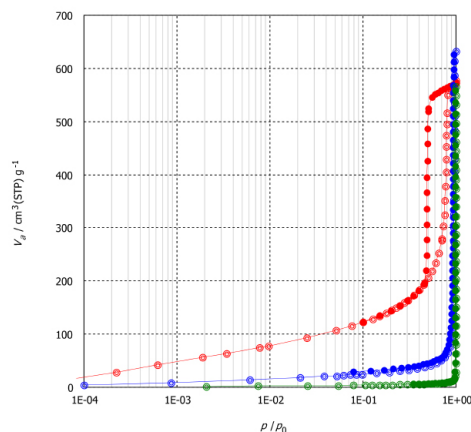
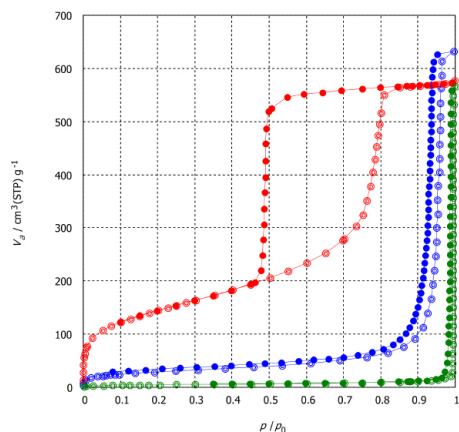
The step-by-step instructions allow users of all levels of experience to operate the instrument safely and effectively. Simple Mode needs sample labeling, pretreatment conditions (skippable if externally done) and measurement points; Professional Mode provides detailed configuration of dosing, equilibrium and leak-check options.

WIĘCEJ INFORMACJI → microtrac.com/pl/produkty/pomiar-adsorpcji-gazow/software/belcontrol/

GAS ADSORPTION MEASUREMENTS

EVALUATION SOFTWARE BELMASTER

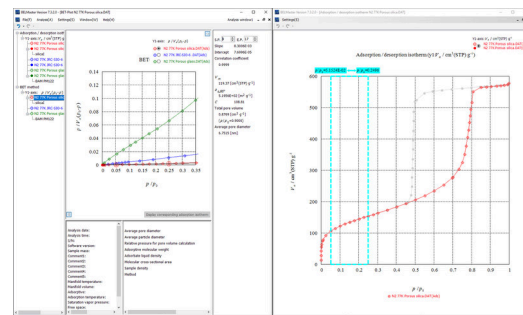
A sorption isotherm is the relationship between the adsorbed amount and the equilibrium pressure of an adsorptive gas at constant temperature. Gas sorption isotherms provide information about specific surface area, pore size distribution and pore volume.



Specific surface area (SSA) refers to a sample's accessible surface area and is important in adsorption and catalytic reactions. It can be calculated according to ISO 9277 with the BET method or by the Langmuir method. Select a pressure range (multi-point BET) or point (single-point BET) and the surface area is calculated automatically; BELMASTER also supports calculation according to ISO 9277 Annex C for microporous materials.

The MINI X measures low-surface-area samples accurately without krypton gas. Its Quick BET Mode obtains three-point BET results from four samples in approx. 15 minutes. BELMASTER derives pore size distributions from 0.7 to 500 nm (optional: 0.35 nm) from measured isotherms.

Microtrac dostarcza analizę rozkładu wielkości porów nowej generacji za pomocą zaawansowanych metod QSDFT, NLDFT i GCMC. BELMaster posiada bibliotekę 59 jąder dla gazów takich jak N₂, Ar i CO₂, umożliwiając dostosowaną analizę zeolitów, mezoporowatej krzemionki i węgla aktywnego.



HIGHEST ACCURACY AT LOWEST SURFACE AREAS

AFSM™

Patented Advanced Free Space Measurement (AFSM™) uses a reference cell to track changes in free space volume and deliver high reproducibility. In a product test, certified reference material CRM-170 (nonporous alpha alumina; certified nitrogen BET SSA: 1.05 ± 0.05 m²/g) is used to check accuracy in low total-surface-area measurements. Even as total surface area falls from approx. 2 m² to below 0.4 m², measured BET SSA remains almost identical.

Próbka	Adsorption	Total surface area in cell [m²]	Sample amount [g]	SSA BET [m²/g]	C constant
BCR-170_1	N ₂	~2 m²	~1.94	1.03	114
BCR-170_2	N ₂	~1 m²	~1.12	1.02	143
BCR-170_3	N ₂	~0.7 m²	~0.75	1.03	101
BCR-170_4	N ₂	~0.4 m²	~0.38	1.02	50

*Correlation coefficient 0.9995 or higher

BELSORP MINI X

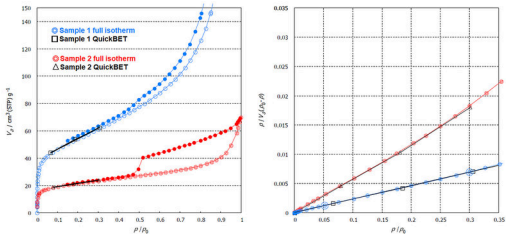
QUICK BET MODE

Quick BET Mode maximizes throughput: three BET adsorption points of four samples can be measured in approx. 15 minutes (sample density required). A previous free-space measurement file can be reused, or free space can be measured together with the sample.

Próbka	Standard Mode multi-point	Quick BET multi-point	Standard Mode single-point	Quick BET single-point
1	189.9	190.5	188.1	190.3
2	75.7	77.4	74.7	75.7

BET SA in m²/g; N₂ adsorption. Multi-point p/p₀ 0.05–0.30; single-point p/p₀ 0.20.

The multi-point and single-point Quick BET results are fully comparable to Standard Mode, with greatly reduced measurement time.



BELSORP MINI X

ZASADA DZIAŁANIA

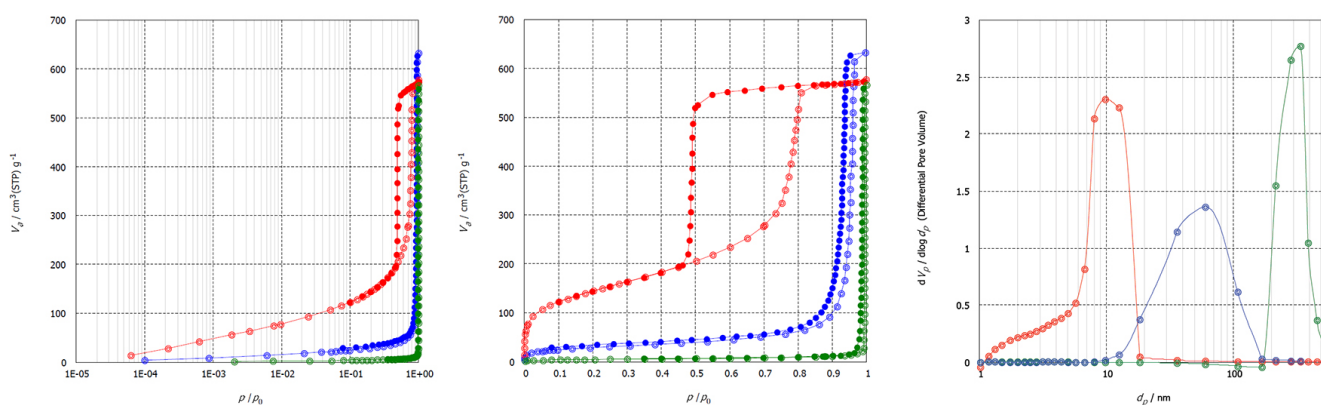
ANALYSIS OF PORE SIZE DISTRIBUTION VIA NLDFT & GCMC METHOD

Classical pore size distributions are calculated by INNES (slit shape) and BJH, DH, CI (cylinder shape) for mesopores; HK, SF and CY methods evaluate micropores. NLDFT and GCMC (optional for BELSORP MINI X) extend analysis across micro-, meso- and macropores and are specified in ISO 15901-2.

Teoria	Oddziaływanie powierzchni i gazu	Adsorbat	Zakres rozmiarów porów
Metoda BJH, CI, DH, INNES	równanie Kelvina (Napięcie powierzchniowe i kąt zwilżania)	Gęstość objętościowa cieczy	> 2 nm; Mezo and makropory
Metoda HK, SF, CY	Potencjał Lennarda-Jonesa (Interakcja i siła odpychania)	Gęstość objętościowa cieczy	0,4 - 2 nm; Mikropory
NLDFT, GCMC	Statystyczny model termodynamiczny		0.35 - 500 nm; Whole pore range

W ostatnich latach zwrócono uwagę na metody określania struktury porów przy użyciu technik symulacji komputerowych, takich jak NLDFT (Non-localized Density Functional Theory) i GCMC (Grand Canonical Monte Carlo), które przedstawiają ujednoliconą teorię charakterystyki rozkładów porów od mikroporów do mezoporów i makroporów. Microtrac zapewnia metody charakterystyki w oparciu o adsorpcję N₂ (77,4 K), Ar (87,3 K) i CO₂ (298 K). Oprogramowanie BELMASTER umożliwia łatwe porównanie izoterm eksperymentalnych i symulowanych, przy czym podstawą do obliczeń PSD jest izoterma symulowana.

In the following part an example for pore size distribution calculation by BJH method is given:



BELSORP MINI X is equipped with 1000 torr pressure transducers; isotherm starts from $\sim p/p_0$ of 1×10^{-4} . Option: 0.35 nm possible by molecular probe method. Z zastrzeżeniem zmian technicznych i błędów.

BELSORP MINI X

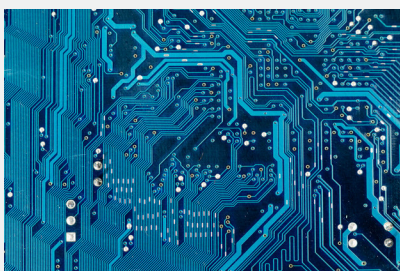
TYPOWE APLIKACJE

Analizatory adsorpcji gazów Microtrac są używane w różnych dziedzinach. Należą do nich katalizatory, baterie, włókna, materiały polimerowe, zeolit, ogniwa paliwowe, chemikalia, pigmenty, kosmetyki, MOF/PCP, proszki magnetyczne, membrany rozdzielające, filtry, tonery, cement, ceramika, półprzewodniki i wiele innych.



MATERIAŁY ENERGETYCZNE

- | materiały baterii
- | katalizatory
- | zeolit
- | ceramika
- | węgiel



MATERIAŁY PRZEMYSŁOWE

- | komponenty elektroniczne
- | ogniwa paliwowe
- | Toner
- | Cement
- | medycyna/farmacja



MATERIAŁY SPECJALNE

- | Krzemionka
- | MOF / PCP
- | pigmenty
- | kosmetyki
- | ... i wiele innych!

BAZA APLIKACJI

Aby znaleźć najlepsze rozwiązanie dla swoich potrzeb w zakresie charakterystyki cząstek, odwiedź naszą bazę danych aplikacji.

BAZA APLIKACJI → microtrac.com/pl/aplikacje/baza-aplikacji/

AKCESORIA I OPCJE



STANDARD CONSUMABLE GOODS

The standard consumables comprise sample cells, filler rods, filters, O-rings, caps and weighing platforms. Various sizes of sample cells, quick seals and other optional consumables are also available.



WATER BATH

Easily swap the Dewar with a water bath for measurement temperatures ranging from -10°C to 80°C. A refrigerated / heated circulator is required.



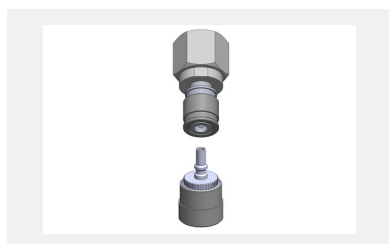
HEATER

In-situ pretreatment of the sample from 50°C to 550°C, directly at the measurement port without transferring the sample cell before analysis. Particularly useful for sensitive samples.



GAS SELECTOR

The gas selector enables the connection of up to 4 adsorptives simultaneously (1 x Helium + 4 x adsorptive).



SYSTEM POMIAROWY AIRGUARD

System pomiarowy AirGuard umożliwia dokładną analizę powierzchni BET i rozkładu wielkości porów na instrumentach BELSORP, jednocześnie chroniąc wrażliwe próbki przed kontaktem z wilgocią i tlenem. Dzięki prostemu montażowi jednym dotknięciem, AirGuard zapewnia pomiary o wysokiej precyzji bez wydłużania czasu analizy. Można go również zamontować w istniejących systemach BELSORP.

BELSORP MINI X

DANE TECHNICZNE

Zasada pomiaru	Technika wolumetryczna + AFSM™
Adsorbaty - gazy	Azot (N ₂), argon (Ar), metan (CH ₄), etan (C ₂ H ₆), tlenek węgla (IV) (CO ₂), wodór (H ₂), n-butan (n-C ₄ H ₁₀), izobutan (izo-C ₄ H ₁₀) oraz inne gazy niekorodujące
Porty do podłączania gazów	2 porty (maks. 5 portów)
Liczba pomiarów (tryb wysokiej dokładności)	Maks. 4 porty jednocześnie (3 porty w trybie wysokiej dokładności)
Zakres pomiarowy (powierzchnia właściwa)	0,01 m ² /g i więcej (N ₂) (w zależności od gęstości próbki)
Rozkład wielkości porów (średnica)	0,7 - 500 nm, opcja: 0,35 nm możliwa metodą sondy molekularnej
Izoterma niskiego ciśnienia	$p/p_0 = 10^{-4}$ (N ₂ @77K, Ar @87K)
Przetwornik ciśnienia	133 kPa (1000 Tr) x 6 szt.
Próżniomierz / pompa próżniowa	Pompa rotacyjna
Probówka	Standardowa probówka, ok. 1,8 cm ³ (opcjonalnie: 5 cm ³)
Naczynie Dewara	Pojemność: 2 l; Czas utrzymywania: 30 h
Piec do obróbki wstępnej próbek	50 - 450°C (4 porty)
Łaźnia wodna	-10 - 80°C (4 porty)
Oprogramowanie analityczne BELMaster™ 7	Izoterma adsorpcji, powierzchnia właściwa BET typ I (ISO9277) autoanaliza BET, powierzchnia właściwa Langmuira, BJH, DH, CI, metoda INNES
Oprogramowanie analityczne BELMaster™ 7 cd.	T-plot, NLDFT / GCMC (OP BELSim™), metoda MP, metoda Dubinina-Astakhova, sonda molekularna, as-plot
Wymiary (szer. x wys. x gł.)	280 x 650 x 465 mm (bez pompy próżniowej i PC)
Masa (aparat podstawowy)	38 kg (bez pompy próżniowej i PC)
Użytkowanie - gaz	He, N ₂ (czystość 99,999% lub wyższa), 0,1 ± 0,02 MPa, złącze: Swagelok 1/8"; Wylot: Port wylotowy pompy rotacyjnej, ø 11 mm
Użytkowanie - zasilanie	Jednofazowe, AC 100~240 V (50/60 Hz) / 10 A (w tym R.P.), 50/60 Hz
Certyfikat CE	tak
Zalecany monitor	Monitory Full HD

BELSORP MINI X

KONTAKT →

microtrac.com/pl/contact-services/general-request/?prefilltext=contact_form.request&product=602

POPROŚ O OFERTĘ →

microtrac.com/pl/kontakt/quote-request-form/?prefilltext=contact_form.quote_request&product=602



MICROTRAC
a **VERDER** company

microtrac.com/pl/produkty/pomiar-adsorpcji-gazow/powierzchnia-wlasciwa-i-wielkosc-porow/belsorp-mini-x/

© Microtrac – microtrac.com / Content may be subject to modifications or corrections