Purchase Contract

(hereafter the “**Contract”**)

1. **CONTRACTUAL PARTIES**
   1. **Fyzikální ústav AV ČR, v. v. i.,**

with seat: Na Slovance 1999/2, 182 21 Praha 8, Czech Republic

represented by: RNDr. Michael Prouza, Ph.D., Director,

registered in the Register of public research institutions of the Ministry of Education, Youth and Sports of the Czech Republic.

ID No.: 68378271

Tax ID No.: CZ68378271

Bank: UniCredit Bank Czech Republic and Slovakia, a.s.

Account No. IBAN: CZ3127000000002106535627; SWIFT (BIC): BACXCZPP

(hereinafter the “**Buyer**”)

and

* 1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,**

with seat: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

represented by: \_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_,

registered in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

ID No.: \_\_\_\_\_\_\_\_\_\_\_\_

Tax ID No.: \_\_\_\_\_\_\_\_\_\_\_\_

Bank: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Account No. IBAN: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; SWIFT (BIC): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (TO BE FILLED IN BY THE BIDDER)

(hereinafter the “**Seller**”),

(the Buyer and the Seller are hereinafter jointly referred to as the “**Parties**” and each of them individually as a “**Party**”).

1. **FUNDAMENTAL PROVISIONS**
   1. The Buyer is a public research institution whose primary activity is excellent scientific research in the area of physics, especially elementary particles physics, condensed systems, solid state matter, plasma and optics.
   2. The Buyer wishes to acquire the subject of performance hereof for growth of layered heterostructures called ‘2D-sandwiches’ using an ultra-high vacuum Molecular-beam Epitaxy System.
   3. The Seller was selected as the winner of a public procurement procedure announced by the Buyer in accordance with Act No. 134/2016 Coll., on Public Procurement, as amended (hereinafter the **“Act”**), for the public contract called **“Molecular-beam Epitaxy System”** (hereinafter the “**Procurement Procedure**”).
   4. The documentation necessary for the execution of the subject of performance hereof consist of
      1. Technical specifications of the subject of performance hereof attached as **Annex No. 1** hereto**.**
      2. The Seller´s bid submitted within the Procurement Procedure in its parts which describe the subject of performance in technical detail (hereinafter the “**Sellers’s Bid**”); the Sellers’s Bid forms **Annex No. 2** to this Contract and is an integral part hereof.

In the event of a conflict between the Contract’s Annexes, the technical specification / requirement of the higher level / quality shall prevail.

* 1. The Seller declares that he has all the professional prerequisites required for the supply of the subject of performance under this Contract, is authorised to supply the subject of performance and there exist no obstacles on the part of the Seller that would prevent him from supplying the subject of this Contract to the Buyer.
  2. The Seller acknowledges that the Buyer considers him capable of providing performance under the Contract with such knowledge, diligence and care that is associated and expected of the Seller’s profession, and that the Seller’s potential performance lacking such professional care would give rise to corresponding liability on the Seller’s part. The Seller is prohibited from misusing his qualities as the expert or his economic position in order to create or exploit dependency of the weaker Party or to establish an unjustified imbalance in the mutual rights and obligation of the Parties.
  3. The Seller acknowledges that the Buyer is not in connection to the subject of this Contract an entrepreneur and also that the subject of this Contract is not related to any business activities of the Buyer.
  4. The Seller acknowledges that the production and delivery of the subject of performance within the specified time and of the specified quality, as shown in Annexes No. 1 and 2 of this Contract (including invoicing), is essential for the Buyer.
  5. The Parties declare that they shall maintain confidentiality with respect to all facts and information, which they learn in connection herewith and / or during performance hereunder, and whose disclosure could cause damage to either Party. Confidentiality provisions do not prejudice obligations arising from valid legislation.

1. **SUBJECT-MATTER OF THE CONTRACT** 
   1. The subject of this Contract is the obligation on the part of the Seller to deliver and transfer into the Buyer’s ownership:

the **Molecular-beam Epitaxy System**

(hereafter the **“Equipment”**)

and the Buyer undertakes to take delivery of the Equipment and to pay to the Seller the agreed upon price.

* 1. The following activities form an integral part of the performance to be provided by the Seller:
     1. Processing of the technical design of the Equipment corresponding to the assignment, including the preparation of the relevant technical drawings, which are subject to approval by the Buyer (As a non-expert, the Buyer will primarily assess compliance with the individual points from table Tab. 1 of Annex No. 1 and the dimensions of the spatial distribution of the Equipment.);
     2. Formulation of conditions which are recommended to be met at the place of Buyer in order to install the Equipment and submission of a list containing all these conditions;
     3. Demonstration of the functionality of the Equipment at the place of manufacture;
     4. Transport of the Equipment incl. all accessories specified in Annexes 1 and 2 of the Contract to the place of delivery, un-packaging and control thereof;
     5. Installation of the Equipment and all components necessary to operate the Equipment including connection to installation infrastructure at the site;
     6. Execution of the acceptance tests:
* He leak test performed on whole Equipment, no leaks detected in the main chamber, buffer chamber, load-lock chamber and transfer arms.
* Base pressure in the load-lock smaller than 8x10-8 mbar after bake-out.
* Base pressure in the buffer chamber smaller than 1x10-9 mbar after bake-out.
* Base pressure in the deposition chamber smaller than 1x10-10 mbar after bake-out, with LN2 cooling in liquid nitrogen cooling shroud.
* Demonstration of substrate loading, transfer and wafer preparation (Si wafer supplied by the Buyer)
* load 2 inch Si substrate on a 2-inch sample holder into load-lock chamber,
* load a 10x10 mm2 Si substrate on a flag-style sample holder, place the flag-style sample holder onto the wafer adapter, place the wafer adapter onto a 2-inch sample holder and load the 2-inch sample holder into the load-lock chamber,
* pump down of load-lock, perform a short bake-out and transfer into buffer chamber,
* heat up the 2-inch Si wafer to 900°C for about 10 min for oxygen desorption,
* load 2-inch Si wafer in growth chamber,
* observe RHEED Pattern of Si wafer (2x1 or 7x7 depending on orientation),
* show how to cool down the substrate using the liquid nitrogen cooling stage.
* Demonstration of operation of all sources:
* Heat up one effusion cell and one high temperature effusion cell and show how to adjust their proportional–integral–derivative (PID) parameters.
* Operate the oxygen atom beam source and show how to control the oxygen flux.
* Load Mo (Mo supplied by customer) in e-beam crucible, operate e-beam evaporator, adjust flux rate for Mo in the range of 0.05 to 0.1 nm/s using quartz microbalance and deposit 10 nm thick layer on the Si substrate on the flag-style holder. There are no requirements concerning the quality of the deposited Mo film.
* Demonstration of MBE control system and process software
* Show how to adjust cell temperatures and shutter operation
* Show how to write a layer deposition script
* Demonstration of shut down emergency procedure
  + 1. Delivery of detailed instructions and manuals for operation and maintenance, including list of spare parts, electrical connection schemes, etc. - all in Czech or English language, in electronic or hardcopy (printed) versions;
    2. Training of operators at the site (at least two-day training of two operators);
    3. Free-of-charge warranty service during the warranty term;
    4. Provision of free technical support in the form of consultations, e.g. regarding fine tuning of the Equipment. The Seller shall provide the Buyer with this free support even after the warranty expires.
  1. The Seller undertakes to carry out the installation of the Equipment according to Section 3.2.5 and provide the warranty service according to Section 3.2.9 through his own employees.
  2. The subject of performance (Equipment) is specified in detail in Annexes No. 1 and No. 2 hereto.
  3. The Seller shall be liable for the Equipment and related services to be in full compliance with this Contract, its Annexes and all valid legal regulation, technical and quality standards and that the Buyer will be able to use the Equipment for the defined purpose. In case of any conflict between applicable standards it is understood that the stricter standard or its part shall always apply.
  4. The delivered Equipment and all its parts and accessories must be brand new and unused.

1. **PERFORMANCE PERIOD**
   1. The Seller undertakes to
      1. prepare technical drawings according to Section 3.2.1 and deliver them to the Buyer for approval within **\_\_\_\_\_ days** (TO BE FILLED IN BY THE BIDDER) of the conclusion of the Contract and
      2. manufacture, deliver and hand over the Equipment to the Buyer within **\_\_\_\_\_ days** (TO BE FILLED IN BY THE BIDDER - maximum for 4.1.1 + 4.1.2 is 330 days) of the Buyer's approval of the drawings.
   2. The Buyer undertakes to review the proposed technical design of the Equipment (technical drawings) according to Section 3.2.1 and, in case it meets the assignment, grant his approval within 30 days of its delivery by the Seller. Along with the technical drawings, the Seller shall submit the list with conditions according to Section 3.2.2.
   3. The performance period shall be extended by a period during which the Seller could not perform due to obstacles on the part of the Buyer.
2. **PURCHASE PRICE, INVOICING, PAYMENTS**
   1. The purchase price is based on the Seller’s submitted bid and amounts to **\_\_\_\_\_\_\_\_ EUR** (in words: \_\_\_\_\_\_\_\_\_\_\_) (TO BE FILLED IN BY THE BIDDER - maximum is 578 000,- EUR)excluding VAT (hereinafter the **“Price”**). VAT shall be settled in accordance with the valid Czech regulation.
   2. The Price represents the maximum binding offer by the Seller and includes any and all performance provided by the Seller in connection with meeting the Buyer’s requirements for the proper and complete delivery of the Equipment hereunder, as well as all costs that the Seller may incur in connection with the delivery, installation and testing of the Equipment upon handover, and including all other costs or expenses that may arise in connection with creation of an intellectual property and its protection.
   3. The Parties agreed that the Seller shall be entitled to invoice the Price as follows:
      1. The Seller is entitled to issue an advance invoice corresponding to 40 % of the Price excluding VAT after the conclusion of the Contract;
      2. The Seller is entitled to invoice 50 % of the Price after the demonstration of the Equipment’s functionality at the manufacturer`s facilities based on a signed protocol of the successful demonstration.
      3. The Seller is entitled to invoice the rest of the Price after the handover protocol in accordance with Section 11.4 (hereinafter the **“Handover Protocol”**) will have been signed. In case the Equipment will be delivered with minor defects, the Price shall be invoiced after removal of these minor defects.
   4. All invoices issued by the Seller must contain all information required by the applicable laws of the Czech Republic. Invoices issued by the Seller in accordance with this Contract shall contain in particular following information:
      1. name and registered office of the Buyer,
      2. tax identification number of the Buyer,
      3. name and registered office of the Seller,
      4. tax identification number of the Seller,
      5. registration number of the tax document (invoice),
      6. scope of the performance (including the reference to this Contract),
      7. the date of the issue of the tax document (invoice),
      8. the date of the conclusion of the Contract,
      9. purchase Price,
      10. registration number of this Contract, which the Buyer shall communicate to the Seller based on Seller’s request before the issuance of the invoice

and must comply with the double taxation agreements, if applicable.

* 1. The Buyer prefers electronic invoicing, with the invoices being delivered to [efaktury@fzu.cz](mailto:efaktury@fzu.cz). All issued invoices shall comply with any international double taxation agreements, if applicable.
  2. Invoices shall be payable within thirty (30) days of the date of their delivery to the Buyer. Payment of the invoiced amount means the date of its remittance to the Seller’s account.
  3. If an invoice is not issued in conformity with the payment terms stipulated by the Contract or if it does not comply with the requirements stipulated by law, the Buyer shall be entitled to return the invoice to the Seller as incomplete, or incorrectly issued, for correction or issue of a new invoice, as appropriate, within five (5) business days of the date of its delivery to the Buyer. In such a case, the Buyer shall not be in delay with the payment of the Price or part thereof and the Seller shall issue a corrected invoice with a new and identical maturity period commencing on the date of delivery of the corrected or newly issued invoice to the Buyer.
  4. The Buyer shall be entitled to unilaterally set off any of his payments against any receivables claimed by the Seller due to:
     1. damages caused by the Seller,
     2. contractual penalties.
  5. The Seller shall not be entitled to set off any of his receivables against any part of the Buyer’s receivable hereunder.

1. **OWNERSHIP TITLE**

The ownership right to the Equipment shall pass to the Buyer by delivery.

1. **PLACE OF DELIVERY** **AND HANDOVER**

The place of delivery and handover of the Equipment shall be the Room No. P.04 in the building ‘New Pavilion’ at the premises of the Institute of Physics of the Czech Academy of Sciences at Na Slovance 1999/2, Praha 8, Czech Republic.

1. **NOTIFICATION OF DELIVERY**

The Seller shall notify the Buyer in writing of the exact date of delivery of the Equipment at least 15 days prior to such date, ensuring that the deadline for the performance hereunder is maintained.

1. **COOPERATION OF THE PARTIES**

The Seller undertakes to notify the Buyer of any obstacles on his part, which may negatively influence proper and timely delivery and/or handover of the Equipment.

1. **DEMONSTRATION**
   1. The Seller shall invite the Buyer to participate in the Equipment demonstration at least 14 days in advance.
   2. The demonstration shall take place at Seller’s premises.
   3. The Parties shall execute an acceptance protocol in case the preliminary testing of the Equipment confirms that the Equipment is functional and complies to technical specifications according to Annexes No. 1 and No. 2 hereof.
2. **DELIVERY, INSTALLATION, HANDOVER AND ACCEPTANCE**
   1. The Seller shall transport the Equipment at his own cost to the place of delivery and handover. If the shipment is intact, the Buyer shall issue delivery note for the Seller.
   2. The Seller shall perform and document the installation of the Equipment and launch experimental tests in order to verify whether the Equipment is functional and meets the technical requirements of Annexes No. 1 and 2 hereof.
   3. Handover procedure includes handover of any and all technical documentation pertaining to the Equipment, user manuals and certificate of compliance of the Equipment and all its parts and accessories with approved standards.
   4. The handover procedure shall be completed by handover of the Equipment confirmed by the Handover Protocol containing specifications of all performed tests. The Handover Protocol shall contain the following mandatory information:
      1. Information about the Seller, the Buyer and any subcontractors;
      2. Description of the Equipment including description of all components, their hardware / software setups and serial / production numbers;
      3. Description of executed tests according to Section 3.2.6 of the Contract: type of test, duration and achieved parameters;
      4. List of technical documentation including the manuals;
      5. Confirmation of the training, including a list of participants and information on its extent;
      6. Eventually reservation of the Buyer regarding minor defects and / or unfinished work including the manner and deadline for their removal and
      7. Date of signature of the Handover Protocol.
   5. Handover of the Equipment does not release the Seller from liability for damage caused by its defects.
   6. The Buyer shall not be obliged to accept Equipment, which would show defects (even those that do not - on their own or in connection with other defects - constitute an obstacle to the use of the Equipment). In this case, the Buyer shall issue a record containing the reason for his refusal to accept the Equipment.
   7. Should the Buyer not exercise his right not to accept the Equipment with a defect, the Seller and the Buyer shall list all defects found in the Handover Protocol, including the manner and deadline for their removal. Should the Parties not be able to agree in the Handover Protocol on the deadline for removal of the defects, it shall be understood that all above shall be removed / rectified within 14 days from the handover of the Equipment.
3. **REPRESENTATIVES, NOTICES**
   1. The Seller authorized the following representatives to communicate with the Buyer in all matters relating to the Equipment delivery and handover:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e-mail: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

tel. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (TO BE FILLED IN BY THE BIDDER)

* 1. The Buyer authorized the following representatives to communicate with the Seller in all matters relating to the Equipment delivery and handover:

xxxxxxxxxxxxxxxx  
e-mail: xxxxxxxxxxxxxxxx  
tel. (+420) xxxxxxxxxxxxxxxx

* 1. All notifications to be made between the Parties hereunder must be made out in writing and delivered to the other Party by hand (with confirmed receipt) or by registered post (to the Buyer’s or Seller’s address), or in some other form of registered post or electronic delivery incorporating electronic signature (qualified certificate) to [epodatelna@fzu.cz](mailto:epodatelna@fzu.cz) in case of the Buyer and to …….@...... (TO BE FILLED IN BY THE BIDDER) in case of the Seller.
  2. In all technical and expert matters (discussions on the Equipment testing, notification of the need to provide warranty or post-warranty service, technical assistance etc.) electronic communication between technical representatives of the Parties will be acceptable using e-mail addresses defined in Sections 12.1 and 12.2.
  3. In all technical and expert matters (discussions on the Equipment testing and demonstration, notification of the need to provide warranty or post-warranty service, technical assistance etc.) electronic communication between representatives of the Parties will be acceptable using e-mail addresses defined in Sections 12.1 and 12.2.

1. **TERMINATION**
   1. This Contract may be terminated early by agreement of the Parties or withdrawal from the Contract on the grounds stipulated by law or in the Contract.
   2. The Buyer is entitled to withdraw from the Contract without any penalty from the Seller in any of the following events:
      1. The Seller is in delay with the delivery of the Equipment longer than 2 weeks after the date pursuant to Section 4.1 hereof.
      2. The technical parameters or other conditions set out in the technical specifications defined in Annexes 1 and 2 to this Contract and in the relevant applicable technical standards will not be met by the Equipment at handover.
      3. Facts emerge bearing evidence that the Seller will not be able to deliver the Equipment.
      4. The Seller has violated the obligations specified within the conditions of the Procurement Procedure, in particular the obligations arising from the affidavit according to § 6 paragraph 4 of the Act.
   3. The Seller is entitled to withdraw from the Contract in the event of the Buyer being in default with the payment for more than 2 months with the exception of the cases when the Buyer refused an invoice due to defect on the delivered Equipment or due to breach of the Contract by the Seller.
   4. Withdrawal from the Contract becomes effective on the day the written notification to that effect is delivered to the other Party. The Party which had received performance from the other Party prior to such withdrawal shall duly return such performance.
2. **INSURANCE**
   1. The Seller undertakes to insure the Equipment against all risks, in the amount of the Price of the for the entire period commencing when transport of the Equipment starts until duly delivered to the Buyer. In case of breach of this obligation, the Seller shall be liable to the Buyer for any damage that may arise.
   2. The Seller is liable for the damage that he has caused. The Seller is also liable for damage caused by third parties undertaken to carry out performance or its part under this Contract.
3. **WARRANTY TERMS**
   1. The Seller shall provide warranty for the quality of the Equipment for a period of **\_\_\_\_ months** (TO BE FILLED IN BY THE BIDDER – minimum is 12 months).
   2. The warranty period shall commence on the day following the date of signing of the Handover Protocol pursuant to Section 11.4 hereof. The warranty does not cover consumable parts. Consumable parts mean items contained within the Equipment, which are consumed at regular intervals during the normal use of the Equipment, i.e. parts which have a defined typical lifetime, that does not exceed the warranty period provided the Equipment is used with normal frequency.
   3. Should the Buyer discover a defect, he shall notify the Seller to rectify such defect using the e-mail address: …….@...... (TO BE FILLED IN BY THE BIDDER). The Seller is obliged to notify the Buyer without delay about any change of this e-mail address. The Seller shall be obliged to review any warranty claim within 72 hours (within business days) from its receipt and to propose solution, unless agreed otherwise by the Parties.
   4. During the warranty period, the Seller shall be obliged to rectify any claimed defects within 30 days from receipt of the Buyer’s notification. In cases of unusual defects, the Seller shall be obliged to rectify the defect in the period corresponding to the nature of the defect and to define the deadline for the handover of the rectified Equipment.
   5. During the warranty period, any and all costs associated with defect rectification / repair including transport and travel expenses of the Seller shall be always borne by the Seller.
   6. The repaired Equipment shall be handed over by the Seller to the Buyer on the basis of a protocol confirming removal of the defect (hereinafter the “**Repair Protocol**”). If the Equipment is delivered duly repaired and defect-free, the Buyer will confirm the Repair Protocol.
   7. The repaired portion of the Equipment shall be subject to a new warranty term in accordance with Section 15.1 which commences to run on the day following the date when the Repair Protocol was executed. However, the aggregate warranty period shall not exceed 36 months.
   8. The Seller declares that he shall ensure paid post-warranty [out-of-warranty] service for the period of 7 years after the expiration of the warranty; the service terms shall be identical to those of Sections 15.3 and 15.4.
   9. The Seller undertakes to provide the Buyer with updates of the software controlling the Equipment for the entire term of warranty service.
   10. If the Equipment has defects, due to which it cannot be demonstrably used in full for more than 60 days (period of defects) during six or less consecutive months of the warranty period, the Seller is obliged to deliver new Equipment without defects within 90 days from the date on which the Buyer sent a written notice, unless the Parties agree otherwise.
4. **CONTRACTUAL PENALTIES**
   1. The Buyer shall have the right to a penalty in the amount of 0.1 % of the Price for each commenced day of delay with the performance pursuant to Section 4.1 hereof.
   2. The Buyer shall have the right to a penalty in the amount of 0.05 % of the Price for each commenced day of delay with rectifying of defects claimed within the warranty period.
   3. In case of default in payment of any due receivables (monetary debt) under the Contract, the defaulting Buyer or Seller (the debtor) shall be obliged to pay a contractual penalty in the amount of 0.1 % of the owed amount for each commenced day of delay with the payment.
   4. Contractual penalties are payable within 30 days of notification demanding payment thereof.
   5. Payment of the contractual penalty does not prejudice the rights of the Parties to claim damages.
   6. Payment of the contractual penalty cannot be demanded if the breach of the contractual obligation causes force majeure. Circumstances related to the Covid-19 epidemic shall be considered as force majeure cases despite the fact the epidemic is already underway at the date of this Contract.
5. **DISPUTES**

Any and all disputes arising out of this Contract or the legal relationships connected with the Contract shall be resolved by the Parties by mutual negotiations. In the event that any dispute cannot be resolved by negotiations within sixty (60) days, the dispute shall be resolved by the competent court in the Czech Republic based on application of any of the Parties; the court having jurisdiction will be the court where the seat of the Buyer is located. Disputes shall be resolved exclusively by the law of the Czech Republic.

1. **FINAL PROVISIONS**
   1. This Contract represents the entire agreement between the Buyer and the Seller. The relationships between the Parties not regulated in this Contract shall be governed by Czech law, in particular by the Act No. 89/2012 Coll., the Civil Code, as amended (hereinafter the **“Civil Code”**).
   2. This Contract may be changed or supplemented solely by means of numbered amendments in writing, furnished with the details of time and place and signed by duly authorised representatives of the Parties. The Parties expressly reject modifications to the Contract in any other manner.
   3. The Parties expressly agree that the Contract as a whole, including all attachments and data on the Parties, subject-matter of the Contract, numerical designation of this Contract, the Price and the date of the Contract conclusion, will be published in accordance with Act No. 340/2015 Coll. on special conditions for the effectiveness of some contracts, publication of these contracts and Contract Register, as amended (hereinafter the “**CRA**”). The Parties hereby declare that all information contained in the Contract and its Annexes is not considered trade secrets under § 504 of the Civil Code and grant permission for their use and disclosure without setting any additional conditions.
   4. The Parties agree that the Buyer shall ensure the publication of the Contract in the Contract Register in accordance with CRA.
   5. This Contract becomes effective as of the day of its publication in the Contract Register.
   6. The following Annexes form an integral part of the Contract:

Annex No. 1: Technical specification on the subject of performance (In the table Tab. 1, the Bidder shall fill in the columns “Description and specification of the Equipment offered by the Seller” and “Complies YES / NO” and in the table Tab. 2, the Bidder shall indicate the offered number of effusion cells)

Annex No. 2: Technical description of the Equipment as presented in Seller’s bid (Bidder shall present in his bid)

Annex No. 3: Affidavit according to § 6 paragraph 4 of the Act No. 134/2016 Coll.

* 1. The Parties, manifesting their consent with the entire contents of this Contract, attach their signature hereunder.

In Prague

For the Buyer:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

RNDr. Michael Prouza, Ph.D.

Director

In \_\_\_\_\_\_\_\_\_\_

For the Seller:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_ (TO BE FILLED IN BY THE BIDDER)

**Annex No. 1 - Technical specification on the subject of performance**

**Tab. 1 - The Equipment must meet the technical conditions and include components listed in this table.**

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Description and minimum specification of the Equipment as defined by the Buyer | Description and specification of the Equipment offered by the Seller | Complies YES/NO |
|  | **General requirements** |  |  |
| 1 | 1 growth chamber, which is vacuum annealed |  |  |
| 2 | 1 buffer chamber |  |  |
| 3 | 1 load-lock chamber |  |  |
| 4 | 2‐inch wafer-holder system |  |  |
| ‍5 | Buffer chamber is separated from the load lock and growth chamber by ultra-high vacuum gate valves. |  |  |
| ‍6 | Possibility to transfer wafer holder from the load lock into the buffer chamber, without opening the gate valve between the buffer and growth chamber using a linear transfer rod mounted on the load lock. |  |  |
| ‍7 | Possibility to transfer wafer holder from the buffer chamber into the growth chamber, without opening the gate valve between the load lock and buffer chamber using a linear transfer rod mounted on the buffer chamber |  |  |
| 8 | Layer thickness uniformity on 2-inch wafer within 5mm away from edge of wafer smaller than 2.5% |  |  |
|  | **Load lock** |  |  |
| 9 | Base pressure less than 1x10-8 mbar |  |  |
| 10 | Pressure gauge from atmosphere till at least 5x10-9 mbar |  |  |
| 11 | Oil free pre-vacuum pump |  |  |
| 12 | Separate bake-out jacket for only load-lock |  |  |
| 13 | Independently bake-able to at least 150°C |  |  |
| 14 | Fast entry loading door. |  |  |
| 15 | Magazine for at least 5 2‐inch wafer  holders |  |  |
| 16 | View ports to visibly follow the sample during loading and transfer. |  |  |
|  | **Buffer chamber** |  |  |
| 17 | Base pressure less than 5x10-10 mbar |  |  |
| 18 | Pressure gauge at least till 5x10-11 mbar |  |  |
| 19 | Turbo pump, pumping speed for N2 at least 260 l/s |  |  |
| 20 | Isolation valve between turbo-pump and chamber, which automatically closes in the case of an emergency. |  |  |
| 21 | Oil free pre-vacuum pump, base pressure less than 5x10-2 mbar |  |  |
| 22 | Pressure gauge from atmosphere at least to 5x10-3 mbar for pre-vacuum line. |  |  |
| 23 | The buffer chamber has integrated water-cooling. |  |  |
| 24 | Separate bake-out jacket for only buffer chamber |  |  |
| 25 | Independently bake-able to at least 180°C |  |  |
| 26 | Tungsten substrate heater for 2‐inch sample holder with maximum substrate temperature at least 1000°C |  |  |
| 27 | DN40CF port for an UHV suitcase, including two manual DN40CF valves, as short as possible DN40CF T-piece, blinded on one end and the other end connected to the load-lock chamber. |  |  |
| 28 | Wafer adopter to remove in-situ a flag-style sample plate using vacuum suitcase’s woble-stick. |  |  |
| 29 | View ports to visibly follow the sample during transfer and surface preparation. |  |  |
|  | **Growth chamber** |  |  |
| 30 | Base pressure less than 6x10-11 mbar |  |  |
| 31 | At least a cryo-pump with pumping speed for air at least 1500 l/s |  |  |
| 32 | Liquid nitrogen or water cooled trap in front of pump(s) for S and Se trapping |  |  |
| 33 | Isolation valve between pump(s) and chamber, which automatically closes in the case of an emergency. |  |  |
| 34 | Connection from cryopump to load lock chamber, including valves, for cryopump regeneration. |  |  |
| 35 | Double wall liquid nitrogen cooling shroud in chamber, equipped with a baffle to protect the pump(s). The liquid nitrogen's inlet and outlet connector must be able to connect to a vacuum insulated liquid nitrogen transfer hose with at least an ISO-KF25-type coupling. |  |  |
| 36 | Pressure gauge at least till 3x10-11 mbar |  |  |
| ‍37 | Bake-out jacket and heaters for growth chamber. |  |  |
| 38 | Whole chamber bake-able to at least 180°C |  |  |
| 39 | Substrate manipulator for 2‐inch sample  holder with computer-controlled tungsten heater with maximum substrate temperature to at least 1000°C and continuous rotation up till at least 30 rpm |  |  |
| 40 | Liquid nitrogen cooling stage for 2‐inch sample holder with a temperature range from at least -173°C till room temperature. The whole 2-inch wafer should be in direct contact with the liquid nitrogen cooled metal stage. Rotation of the sample when using the liquid nitrogen cooling stage is not a requirement. |  |  |
| 41 | Main shutter on substrate manipulator |  |  |
| 42 | RHEED gun (energy range from 500 eV to at least 15 keV) and RHEED screen. |  |  |
| 43 | Quart micro balance mounted on a linear feed-through unit to allow positioning the sensor close to the substrate center. |  |  |
| 44 | Quadrupole mass analyzer 1-200 amu with electron multiplier |  |  |
| 45 | 2 optical ports for ellipsometry or band-edge spectroscopy |  |  |
| 46 | At least 8 source flanges radially arranged, from which at least 2 have a DN63CF flange and the remaining ports have at least a DN40CF flange. All source flanges should be water-cooled. In the center of the bottom flange of the growth chamber, a DN63CF port for the pyrometer. |  |  |
| 47 | View ports, including shutter, to visibly follow the sample during transfer, growth and to visibly follow all the sources and the source its shutter. |  |  |
| 48 | 1 x electron-beam evaporator for Mo and W, crucible size at least 4 cm3, Ni coating of Cu parts to minimize reaction with S and Se, computer-controlled shutter and temperature control and power-supply, view port including shutter to look into the electron-beam crucible. |  |  |
| 49 | At least 3 effusion cells suitable for elements such as Mn, Sn, Ge or SnSe2, maximum temperature 1400°C, crucible size at least 20cm3, computer-controlled shutter and temperature control and power-supply. Stability of the temperature better than ±1 °C. |  |  |
| 50 | At least 3 PBN crucibles with a crucible size at least 20cm3 |  |  |
| 51 | 2 high-temperature effusion cells suitable for elements such as Fe, Co, or Ni, maximum temperature at least 1900°C, crucible size at least 3cm3, computer-controlled shutter and temperature control and power-supply. Stability of the temperature better than ±1 °C |  |  |
| 52 | At least 2 Al2O3 crucibles with a crucible size at least 3cm3 |  |  |
| 53 | Oxygen atom beam source with O2 dissociation at least 80% and no presence of high-energy particles and ions in the beam. PID controlled cracking tube with a maximum reachable temperature of 1900°C, oxygen gas flow controllable in the range 1x10-3 sccm till at least 1 sccm. |  |  |
| 54 | At least 5 wafer holders for 2-inch wafers, with wafer adapter to mount flag-style sample plates directly to the heater or liquid nitrogen cooling stage. |  |  |
|  | **Software** |  |  |
| 55 | Computer including software for RHEED data acquisition and oscillation evaluation and software for quadrupole mass analyzer. Computer should have at least Windows 10 or an open-source distribution with long term support. |  |  |
| 56 | System controller, including monitor to visually follow the system and keyboard and mouse/touchscreen to control the system. The system controller should control at least the cooling water flow, vacuum system, electrical power management and bake-out process and act appropriate when a problem occurs in one of those processes.  The system controller should be based on industrial grade programmable logic controller(s). |  |  |
| 57 | Separate computer with control software to control the growth process itself. The software should allow to create recipes for the growth of materials, where at least the substrate temperature and each source it’s temperature and shutter can be controlled. Computer should have at least Windows 10 or an open-source distribution with long term support. |  |  |

(Bidders shall fill in the columns “Description and specification of the Equipment offered by the Seller” and “Complies YES / NO”.)

**Tab. 2 – Data on “Total number of effusion cells”**

|  |  |
| --- | --- |
| **Number of effusion cells (Annex 1, Tab.1, item 49) included in the bid price** |  |

(Bidders shall indicate the offered number of effusion cells which also applies to PBN crucibles – minimum is 3.)

**Annex No. 2**

**The Seller’s bid in the extent it describes technical parameters of the Equipment**

(Bidder shall present in his bid)