



No. NML-FG/MTE-KGK/40-19/Corr-II

Date: 28.11.2019

CORRIGENDUM - II

Sub: Tender for supply of Laboratory Scale Inert Gas Atomizer for producing High Purity Spherical Metal/Alloy Powders.

Ref: 1) Enquiry No. NML-FG/ /MTE-KGK/40-19 Dated 05.11.2019
2) CPPP Tender ID No. 2019_CSIR_490040_1

With reference to the above procurement, It is informed that technical specifications have been revised as per Annexure-I. The bid may be submitted as per the revised technical specifications. All other terms and conditions will remain unaltered.

(N K. Singh) 28/11/19
Stores & Purchase Officer

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**Technical specifications for
"Laboratory scale inert gas atomizer for producing spherical metal/alloy
powders"**

The laboratory scale integrated Inert Gas Atomizer (IGA) should be capable of producing spherical metal/alloy powders in batch production. The atomizer should be capable of producing both (i) pure metal powders of iron (Fe), nickel (Ni), copper (Cu) etc. and (ii) wide range of alloy powders based on Fe, Ni, Co etc.,

It should have provisions to control the particle size, based on the process conditions and the typical d_{50} of the produced powder in a batch should be about $40 \pm 10 \mu\text{m}$, where d_{50} is mass median diameter. In addition, ability to produce fine powders where $d_{50} < 30 \mu\text{m}$ and coarse powders where $d_{50} > 50 \mu\text{m}$ is also acceptable.

The detailed specifications of the "Laboratory scale inert gas atomizer for producing spherical metal powder" comprising: 1) Melting system 2) Atomization system 3) Powder collection system and 4) Control system, are given below:

1) Melting system: The inert gas atomization system should include melting furnace preferably based on induction heating. The melt capacity/crucible volume should be of minimum 0.4 litres and a maximum of 2.0 litres.

- i) The melting furnace chamber should be capable of achieving vacuum level of about 5×10^{-2} mbar or better in less than 120 minutes at room temperature.
- ii) The furnace (operable in vacuum and inert atmosphere) with required power rating, induction coils, power leads, radiation shield etc. should be capable of attaining working temperatures up to 1700°C .
- iii) A bottom pouring mechanism for atomization should be provided.
- iv) Melting crucibles suitable for melting high alloy steels, nickel/cobalt based superalloys and copper alloys should be provided.
- v) Should be capable of melting minimum 3.0 kg of steel per batch (or equivalent volume of other metals and their alloys).
- vi) The system should have all the provisions and necessary instrumentation for charging the raw material, melting and controlled atomization.
- vii) The melt chamber should include viewports to observe and systems for continuous measurement and monitoring of liquid metal temperature.

viii) Suitable devices should be included to measure the oxygen level in the melting chamber.

2) Atomization system:

- i) The features of atomization system should include
 - Atomization under inert gas atmosphere (N_2 / Ar)
 - Melt atomization through close-coupled nozzle assembly
 - Inert gas (Nitrogen/Argon) supply system
 - All essential devices/instruments to control, operate and atomize the molten liquids.
 - Provision to vary critical atomization process parameters to achieve the desired purity and particle size range.
- ii) The atomization chambers should also include viewports to observe and provision for CCD cameras for real-time recording of atomization process.

3) Powder collection unit:

- i) Provision to collect the atomized metal powder directly from the atomization chamber without exposing it to outside environment.
- ii) Suitable stainless steel containers (4 Nos.), detachable from the atomization chamber so that the powder filled containers can be taken out without exposing it to outside atmosphere.
- iii) Efficient cyclone separator to collect the atomized powder.

4) Control system:

- i) State-of-the-art instrumentation to facilitate easy and smooth operation and control of the inert gas atomization system at every stage, along with all the necessary safety features.
- ii) Computer based control system with real-time display and recording of all the operating parameters and capable of user friendly programming.
- iii) Adequate safety features to prevent any kind of fire hazards, explosion, electrical short circuits and other dangerous situations to either operators or

people around the unit during operation. The warnings should be in the form of visual displays on screens and sirens etc., as required.

Other essential accessories:

- i) All electrical cables, connectors and accessories, including the main power supply cables / plugs, will be provided by the supplier.
- ii) The system should be operable under Nitrogen as well as Argon atmosphere and fitted with all the necessary control valves, pressure gauges (with indicators) and safety relief valves and gas inlet temperature gauge, gas mass flow meter, gas oxygen analyser as well as gas moisture sensor.
- iii) The supplier should provide detailed drawings/illustrations/photographs etc. for efficient operation and usage of the system. All the operation manuals, equipment related documents (both soft copy and hard copy), general assembly drawings and circuit diagrams must be in English language.
- iv) The vendor should provide list of essential spares and consumable items with price. This will not be included in the price bid comparison.
- v) Should provide consumable parts for initial trial runs required to demonstrate the installation and commissioning of the equipment and further for 50 subsequent runs.
- vi) The system should be complete in all respect, including all the necessary components/accessories for total installation and smooth operation of the equipment. No optional items will be accepted.
- vii) CSIR-NML will provide only the following:
 - Shop floor with suitable space for installation of the integrated inert gas atomizer
 - Filled gas cylinders (Ar & N₂)
 - Water connection (inlet and outlet) and distilled water (if required for chiller)
 - Civil works (without steel structures) required for installation, if any
 - Electrical power (220 V, 50 Hz / 440V, 50 Hz)
[Note: CSIR-NML has 24x7 power supply. However, if power back-up is mandatory for the IGA system or its sub units the same should be in scope of supplier]

- All other requirements for installation and commissioning are in the scope of the supplier.

Technical bid should contain detailed pre-installation requirements with regard to civil, electrical and water supply.

- viii) The vendor should supply appropriate steel structures, dehumidifiers, pre-heaters, vacuum pumps, gas manifolds (Argon/ Nitrogen) with related instruments such as, pressure regulators, piping and all other accessories required for complete installation, commissioning and regular operation.
- ix) The supplier should include required tools/tackles/in-built lifting hoist / cranes etc., essential for day-to-day operation and maintenance of the system.
- x) The supplier should provide 1 year comprehensive warranty from the last date of successful installation, commissioning, trial runs and training. Should include essential spares for 1 year. Should also quote for non-comprehensive annual maintenance contract (AMC). The price for 1 year non-comprehensive AMC will be included for price bid evaluation.
- xi) The suppliers should have proven record of supply and installation of laboratory/pilot scale inert gas atomization systems in research/academic institutions or industry across the globe. The supplier should provide a list of minimum three (03) such installations along with details of institutes/users with supporting documents.
- xii) The supplier should submit itemwise compliance statement with respect to the above specifications/requirements and also highlight the deviations, if any.
- xiii) All measuring instruments should be supplied with an appropriate and valid calibration certificates.
- xiv) Vendor should supply the water chillers of required capacity, if the system requires the same for trouble free continuous operation.
- xv) For environmental safety of the operators, the exhaust gas should be dust free. Therefore, necessary exhaust systems along with filters should be provided.
- xvi) Should include an air compressor (with dehumidifier) to facilitate the cleaning/ maintenance of IGA.
- xvii) Should include the make (manufacturer) and model of the inert gas atomizer and its accessories quoted (wherever applicable) and associated product brochures/ catalogues and detailed technical specifications.

- xviii) After installation, the supplier should perform necessary initial trials (about 05 Nos) with Fe/Ni/Cu based metals/alloys and demonstrate that the produced powder meets the CSIR-NML specifications with respect to size and shape of the powder.
- xix) After completion of demonstration and trial runs, the supplier should arrange for complete hands-on training for one week (5 working days) to identified CSIR-NML technical staff, on safety issues, smooth operation and day-to-day maintenance of the equipment.


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