

## **Innovative Solutions Canada Program**

### **Challenge EN578-170003/02: 3D Printing and Additive Manufacturing: Metal Powder**

#### **Bed Density Test Equipment**

##### **Amendment 003**

This amendment is raised to answer bidder questions.

#### **Question #4**

What's the configuration of the prototype for the first phase? Can it be a piece of equipment demonstrating the function but separate from a printer, or does it have to be integrated with a real operating printer?

#### **Response #4**

Phase 1 is for the development and delivery of a proof of concept (maximum TRL 4). Prototype development is not included in Phase 1.

Phase 2 is for the further development beyond the proof of concept with the goal of developing and delivering a prototype addressing a federal department/agency's challenge.

#### **Question #5**

According to ISED-ISC, what is the benchmark test method for powder density, against which all sensor data is compared?

#### **Response #5**

It will not be possible to test the results against a reference method. Bulk density measurements depend on how the powder is placed in a given container/volume. The recoater module will place the powder in a specific manner which cannot be strictly reproduced. In general, one uses a standard method such as ASTM B212 or MPIF Standard 04 to measure powder bulk density.

In the challenge description, it is suggested that a gravimetric means could be used to measure the density. The volume of the powder layer could be estimated using the surface and displacement of the platform on which the layer is applied. The weight of the powder layer could be measured using a load cell below the platform. It is also suggested in the challenge that the powder layer thickness could be estimated using an optical means.

Although apparently simple, the actual volume of the powder layer is quite complex and it expected that every means of measuring it (or estimating it) will result in a slightly different value.

#### **Question #6**

Is this sought specifically for laser powder-bed fusion or also for electron beam powder bed fusion?

**Response #6**

The equipment is not specific to laser or electron beam technologies. The key aspect is the reproduction of the means by which the recoater manipulates the powder and produces the layers. Ideally, interchangeable modules simulating the operation in various laser and electron beam 3D printers would be available.

**Question #7**

Are there specific materials (i.e. which alloys of metal powders?) or suppliers of powders (e.g. AP&C, Tekna, Equispheres, US-based companies, etc.) or powder types (fabricated via water-atomized, gas-atomized, plasma-atomized, etc.) which ISED and/or NRC wishes to ensure inclusion in this project?

**Response #7**

No powder producers are involved in the challenge. The equipment should be capable of testing all types of metal powders used for 3D printing. Ideally, it would be able to test other metal powders that are not specifically made for printing.

**Question #8**

With the development of this specific tool, what does Canada hope to achieve, support or produce with its use?

**Response #8**

The equipment is intended for R&D as well as quality control purposes. Producers and users of 3D printing metal powders could benefit from the better characterisation of the behaviour of powders. The tool will allow study of the impact of different factors (powder attributes, recoater design and operation) influencing the powder bed quality. The knowledge acquired will contribute to improve the quality and reproducibility of the parts manufactured using the powder bed type technologies.