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POWDER FLOWABILITY SCREENING TOOL

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Title:

Powder flowability screening tool

Abstract:

In the industry of the 3D Additive Manufacturing printing, the selection of possible powders which could work correctly in the printer makes a crucial role. The ability to preselect a possible new powder and disregard some others in an early stage of development can save time and future inversions.

Problem Solved:

When a new powder wants to be implemented and included in the materials range of an AM printer, there are some properties which must be fulfilled in order to guarantee the full functionality of the powder in an end-to-end solution.

One of the most important properties of the powder is the flowability, which will determine if a powder is able to move and be handled through all subsystems without having issues. With this tool, a fast, cheap and reliable screening of the flowability of every powder can be made, so it will disregard powders which would not normally be able to be used in AM printing operations.

This tool will act as a first filter and it will allow to focus on other materials with a higher potential, saving time and money.

Prior Solutions:

To the knowledge of the inventors, there are currently two approaches to determinate the powder flowability:

- A) Shear cell tool. This tool is able to reproduce the flow function of a given powder in a specific condition (temperature, time consolidation, moisture content...). With this tool, any situation of the powder within the printer can be characterized but the procedure is highly time-consuming and the price is elevated. Therefore, characterizing the powder in each state is not feasible.
- B) Avalanche tool. This tool allows to estimate the flowability of the powder taking into account the angle and energy of avalanche. It consists of rotating a cylinder comprising powder therein. Although it is a fast method, it is not fully reliable and it cannot reproduce all the environmental conditions of the powder in the printer.

Description:

The present invention is a new approach to the problem using shear stresses of the powder

while it is moving. The objective of the invention is to determine the value of an angle that, upon a pre-consolidation stress, makes powder slip. To illustrate the previous, the following figure is representative of the tool and its components:

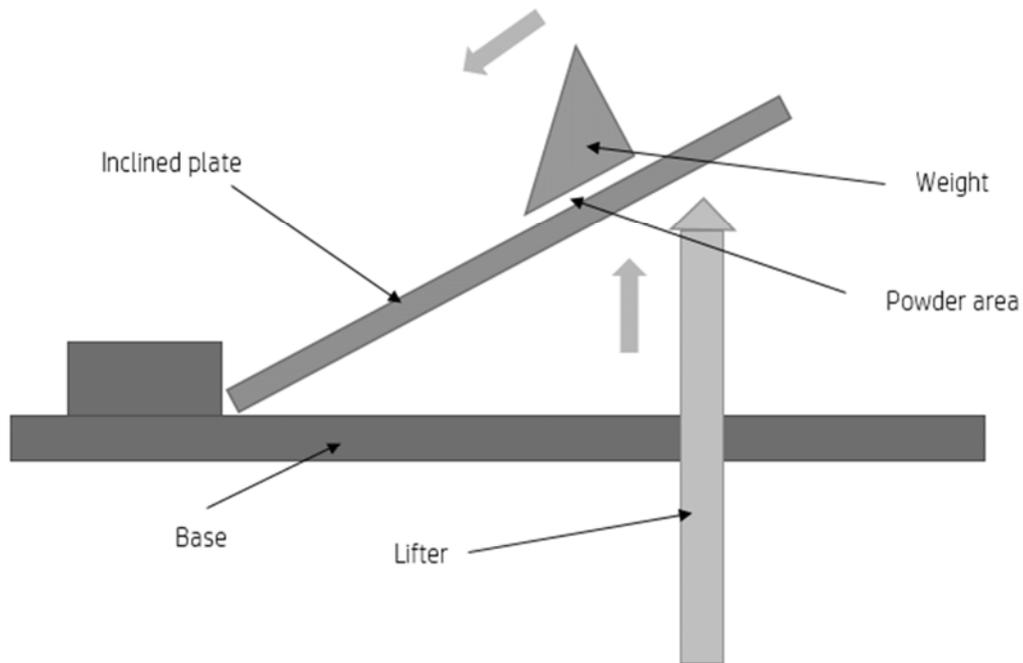


Figure 1. Invention hardware

The system works as follows:

1. A plate rests on the base.
2. The plate has a layer of 1mm of powder on it.
3. A triangular shaped weight is placed on the layer of powder, compressing it.
4. One side of the plate is lifted by the lifter, therefore incrementing the angle of inclination.
5. At a certain angle, the weight makes the powder slip.
6. This angle represents an approximation of the flowability of the powder.

To assure that two consecutive layers of powder are slippery with respect each other, a rough coating must be applied on the surface of both, the inclined plane and the weight. The next figure represents an illustration of the elements just before slipping of the weight.

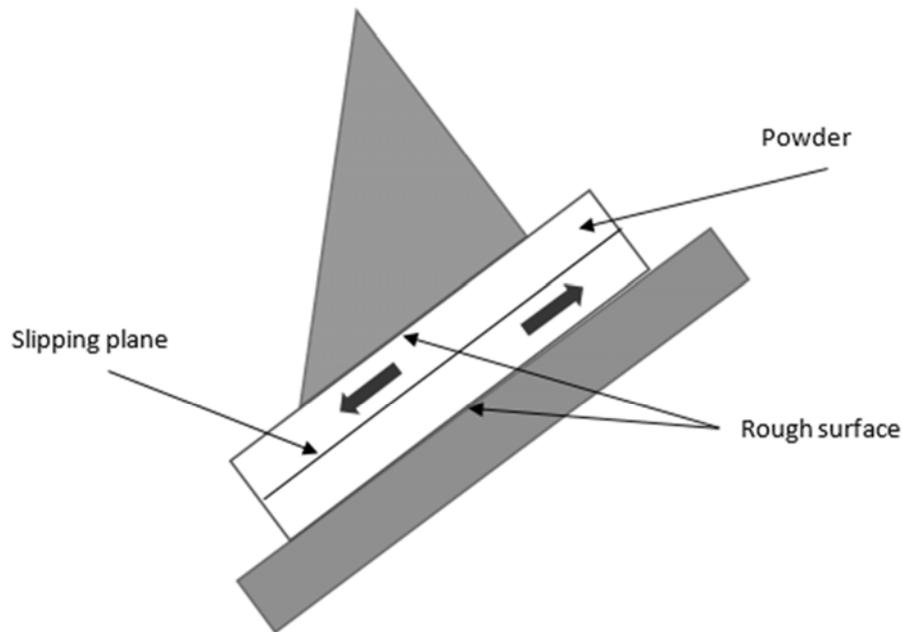


Figure 2. Slippery state

The slipping plane within the powder layer (1mm thickness) is created and slips, i.e., the cohesive forces are not enough to avoid the flow. It is supposed that the slipping plane is parallel to the inclined plate.

Furthermore, this tool allows to increment the pre-consolidation stress changing the weight of the piece and can be tested with different temperature and moisture conditions.

Every powder has different cohesiveness which can be directly related to the angle of slippery. The bigger the angle of inclination is, the more cohesive a powder is. Therefore, a ranking of powders regarding its flowability can be done.

Advantages:

This invention allows a fast and effective screening of future powders which will never be able to flow in the AM printer, saving time and investment.

Disclosed by Albert Iglesias and Fernando Juan, HP Inc.