

INVESTIGATION SYSTEM FOR HARD METALLIC POWDERS

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Issues of the project refer to accomplishing hard sintered materials using specific powder metallurgical control technologies and systems.

These proceedings have been generated as a necessity to obtain a variety of high level products from the point of view of the physic – mechanical characteristics, mainly hardness, being a higher level compared to any kind of steel obtained using classic elaboration methods.

Composite materials are based on strict rules with granulometric definite fractions, lilted and with reinforcing materials.

In order to define families of materials are necessary to accomplish some specific investigation and control tests for:

- main chemical compounds proportions
- dimensional gradient for each component
- lilted degree

In order to identify the main parameters may be realized well defined mixtures to be used for precise activities:

- splintering plates
- wear products
- products with special destination

The main priorities imposed by the powder mixtures means to accomplish a high level control of the mixtures and of the main influencing parameters.

A increased precision for accomplishing their evaluation investigation directly contributes to the end products increased quality degree made of composite alloys type sintered metallic powders.



The system is composed by the following main elements:

- 1- ant vibration mass damping socks and vibrations from the laboratory or in the place where are made the determinations. The mass is composed by 2 stainless steel frames, on one frame is put a finished stone and the other frame is used as a table for the laboratory application. The stone is put on the frame on some plastic puffers that are put at the frame legs too. These



puffers together with the stone realizes a protection system against vibrations and socks dat may appear during determinations.

2- The basic plate on which are made the connections with the other sub ensembles components of the investigation system.

On the plate are the following connections:

- electrical connections
- pneumatic connections
- connections with the pc

3- the pneumatic plate is fixed on the inferior frame anti vibration table. On the table are fixed:

- the vacuum pump
- electro valves for control
- electro valves for depression

4- columns for measurement (fixed on the basic plate) with the following devices:

- for determining the powders apparent density
- for determining the flow speed
- for determining de apparent density of :

semi product

sintered product

5- thermo balance for determination:

powders humidity

powders mass

6-the bell is made by a glass of 10 mm, scurried and stickled in uv.

It also has a fixing system with 2 hammers with rapid fixing system fixing the 3 mm thick silicon fittings to achieve the tightness.

7- the argon bottle connected to the installation has clocks indicating the debit control and argon pressure

8- the automation panel to achieve the vacuum and the environment with argon and for determination of the flow speed of the metallic powders by the control panel is controlled the vacuum pump and when it is obtained an absolute resign of 0,8 bar an acoustic and visual signal appears and stops the vacuum pump by using the electro valve.

This is the moment when the other control valve allowing the argon entrance till the absolute pressure of 0,95 provides the acoustic and visual signal.

9- the touch screen setting the vacuum values and the argon pressure, the maintenance time and the control buttons starting the automate process of creating the neutral environment in order to determinate the apparent density and the flow speed in the argon environment.

10- software application picdur-program is characterized by specific investigation hard type composite materials.

The picdur-application is characterized by:

- functions anf sub routine for simple and intuitive operation: includes a friendly graphic intergace to provide interactivity with the user by windows and keys
- provides interface with the investigation system
- provides the first data analyze
- provides the interesting data stocks in files
- provides a report with the results

11- the pc ruling the pressure monitoring soft and the picdur dedicated soft



I. Determination of the apparent powders density:

The sample is poured in the device for determining the apparent density which is a part of the investigation system. By the help of a non magnetic fork the powder is smooth on the surface of the device by a single passing , without pressing removing the additional powder and taking care of not providing shocks or vibrations during operation.

The process of determination the apparent density starts by the start order in the picdur program acting the opening key of the device trap and the powder flows on the balance platen.

The apparent density is determined by using the following calculation algorithm
....in orig...

Were:

m- the powder mass indicated by the balance

V- the device volume for the powder(...in orig...for the investigation system)

Values of the density higher then the value indicated by the producer means:

- small balls (fine class till max....in orig...) – high flow speed
- shape factor (min/max size) is ...in orig...
- insufficient covering degree:
- * particles completely covered
- thin paraffin layer
- high humidity
- prescription with much wolfram carburets for the smaller densities

indicated by the producer the powder characteristics are opposable with the one mentioned before according to the resulted values the manufacturer may remedy the flow anf the producer may decide to change the production flow for other products not needing improved physic characteristics.

II. Determination of the powder flow speed

Determination is verified simultaneously with de apparent density determination

It is recommended by touch screen (press on the el-magnet function) the device trap determining the apparent density.

After the trap opening the powder flows through the device determining the flow speed formed by a funnel with a calibrated opening of 2,5 mm.

The powder flows on the balance platen for 10-20 seconds according to the powder granulation and other physic characteristics indicated by the producer.

When the powder touches the platen the modified mass in the balance starts in the picdur program a chronometer with the precision of 0,5 sec.

While the powder flows the balance indicates the corresponding powder mass deposited on the platen.

When the flow is over, the balance indication become stabile as the mass and the chronometer is stopped.

The volume flow speed of ...in orig... is displayed in g/s or s/100g.

According to each prescription for the powder is a optimal flow indicated by the producer determined experimentally.

A high speed (better then indicated by the producer) means:

- * small dimension of the powder particle corresponding to the fine precision class – max.1,5 um
- * form factor (max/min dimension) is ...in orig...
- * atomized uniform particles (coated by paraffin)



* powder with high wolfram carburets between 3 and 30%
* humidity degree of the powder is very small
Obtaining the flow speed smaller than the one indicated by the producer means opposite characteristics than the one presented above.

Thus it is necessary a microscope investigation to the beneficiary of the following characteristics:

- particle medium dimension
- min particle dimension
- max particle dimension
- degree of coating with para fine

These investigations are necessary, the producer can remedy the production flow and the user (beneficiary) makes the same for something else not needing good flow characteristics (fill in the matrix in automate cycles or products with low physic characteristics)

It is necessary to take probes/samples from each process and to verify them.

Determination of the pulverulent parameters for precision class

(according Kenneth ja brookes – technical manual for presentation of the hard and extra hard materials:

- fine class: with particles till max...**in orig...**
- medium class:.....**in orig....**
- thickness class: over...**in orig...**

Dimensions definition and identification of the pul virulent particles takes in to consideration their form/shape factor (report between min and max dimension of the particles)

The ideal shape factor is "1" providing a very good flow by a very rapid and uniform fill in of the matrix providing sintered products with small porosity, thus improved hardness and breakings for the splintering tools.

III. Determination of the apparent density and of the flow speed in the argon purified environment

Determination is verified according the procedure showed before when determination are done in purified environment (argon) at a max pressure of 0,95 bar.

After the fill in of the device with metallic powder the bell is fixed to realize the inert environment.

The process of obtaining the vacuum at the absolute pressure of 0,6 bar is controlled by touch screen (start).

This is monitored by a pressure sensor when the vacuum pump stops ant is opened for the argon pass till the absolute pressure of 0,95 bar (for a better tight).

When the pressure of 0,95 bar is provided the pressure sensor starts the visual and noise signal to tell the operator that investigation has started. It must be verified in the same time the apparent density and the flow speed of the powder sample.

According to the obtained results is analyzed the influence of a purified environment over the flow speed of the powders, critical parameter in the sintered parts manufactured by hard metallic powders. The flow speed influences the matrix fill in degree and the semi manufactured and finalized products.

Determinations are made on samples from the same flow in order to verify the flow speed both in the oxide environment and in the purified with argon environment.

The obtained results in several groups of powders having different granulation allow taking some decisions on fill in technologies for the sintered parts.



IV. Powder humidity degree

Determination is verified using the loosing mass method.

A quantity of hard metallic powder of max. 120 g is put on the balance platen and is made smooth with a non magnetic fork.

The head of the balance is locked

.The picdur program allows the use of 5 methods of determining the powders humidity according to:

- heating temperature
- heating time
- module for results display (percentage, powder mass, humidity mass).

The determination method is set.

The process is started from the balance menu or from picdur program start control.

The drying process will last till the indicated balance will be stable or according to the choose method having a determined heating time.

The humidity percentage must correspond with the indicated percentage by the manufacturer for the verified net.

Determination of the humidity is necessary before fill in. The results obtained allow the user to take the right decision for starting the drying process or changing the fabrication.

Taking into consideration that the metallic hard powders are characterized by a high hygroscopic the user must decide depositing actions and manipulation methods till the production process.

V. Determination of the semi fabricate product density and the sintered product

Determination is verified by a andocation (?) device allowing the product or the sintered product in air and immersed in water weighing.

The semi product density ar the sintered product is determined according the calculation algorithm :.....in orig...

Where:

In orig...= sample mass weighed in air

In orig...= water density...in orig...

In orig...= sample mass and supporting wire weighted in the water

In orig...= wire mass weighted in the water.

The bar is weighted in the air and then is immersed in the water by theandocation (?) device.

The semi fabricated density or the sintered product must be as close as possible to the producer indicated curves regarding the optimal pressing.

For the small pressure the optimum pressing is not obtained but important porosity.

For important pressure is provided a pressing with stratification arias. This influences in a negative way the product quality exposing it after the sintering operation. It is also an increased density of the product meaning a small absorption of water compared to the producer indication. Thus the premature wear of the matrix appears by decreasing the pressing cycles, thus determining high costs/ expenses for the beneficiary.