Enabling the powder metallurgy process to expand to new markets

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There is no reliable method able to inspect parts and detect local defects in green state powder metallurgy parts. The lack of an adequate inspection system has implications from the point of view of production, since it increases the number of rejected parts after sintering.

The aim of DIRA-GREEN project is to develop a new inspection tool for the improved assessment of green parts, which will prove affordable for SME's. Such tool will reduce the production costs and will decrease the amount of powder used to generate the same number of parts, owing the fact that the powder of the rejected parts can be re-used.

The main outcome of the project is the realisation of a Non-Destructive Testing (NDT) technique, which enables online quality assurance of 'green parts', by monitoring compacted material porosity, and identifying microscopic cracks. This innovative tool uses digital radiography to create a density map for each component, indicating the size and location of defects. As the system will be directly integrated into the production line, it will be possible to identify faulty parts in real-time. Valuable data regarding part defects will be stored in a database, and used to improve mould/die design.

DIRA-GREEN consists of the following elements:

1. Mechanical subsystem to allow the manipulation of the inspected part. The green part is placed on a pallet, before it enters the lead chamber on a conveyor belt. Once inside the chamber a

manipulator takes the pallet from the conveyor and moves it into position for inspection. A number of images are taken, for this reason the manipulator can turn and rotate the image. Once the images are taken, the pallet is placed back onto the exit conveyor. The DIRA-GREEN mechanical subsystem concept has been significantly improved compared to the originally proposes system. It became obvious that because of the wide range of part characteristics a universal gripping device is not applicable. Accordingly the task to develop a universal gripping tool is in excess of the DIRA-GREEN project scope. Therefore to make the DIRA-GREEN prototype simultaneously suitable for small and fragile MIM parts and more robust PM parts, a special palette system had to be developed.

2. Lead chamber for the X-ray protection has two sides, a top, bottom and back panels shielding the enclosure. On the front side there is a windowed door turning along the horizontal axis hence, enabling it to open in the upward direction. This door has a lead glass insertion which allows seeing inside the enclosure without the risk of X-ray radiation exposure. There is also a double door at the front which locks the window door from opening while the X-rays are in use.
3. Digital radiography subsystem consisting of an X-ray source and a detector.
4. Control system that allows the control of the mechanics and the digital radiography system. For controlling the motion control subsystem from a host computer a User Interface has been developed. The programs are communicating via a direct Ethernet connection. The front panel has 4 main parts: connection pane, system status window, motion control tab, system monitoring tab.
5. Evaluation software uses image processing to compare the recorded image to a golden image (image of a perfect part) and identify any discrepancies of the inspected part.

The DIRAGREEN prototype has been integrated and validation tests have been carried out in laboratory conditions. The system is operating to a satisfactory level, however some fine tuning is necessary.

More information: For further information, please visit: www.diragreen.eu

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