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FUSING MODULE PARTICLES DETECTION

HP INC

Fusing Module Particles Detection

Overview of the system

Currently, powder recyclability is very important to calculate total cost of ownership (TCO) and 3D printing efficiency.

Below is explained a way to detect and identify particles surrounding the external or internal surface from fusing module glasses. These particles may interfere in the energy propagation and irradiance to the bed.

This system can detect and decide if the number of particles present on the glass will affect print quality and advise the user to clean it or replace it if needed due to degradation.

Which are the problems that this system solves?

The presented solution solves issues like fusing lamp calibration failures due to particles on glasses, burnt spots or poor maintenance. Early powder detection inside of the modules that could lead to imminent lamps deterioration is also detected, improving quality of the energy propagation and irradiance. This helps avoids part quality defects like non-well fused parts, poor mechanical properties, color uniformity, thermal defects.

How does the systems work?

Fusing Lamp Modules are in direct contact with powder material. Movement, electrostatic charge and temperature are critical factor which lead to particles adhesion to the glass covering the fusing lamps. This enclosure can be directly exposed to the powder during the printing process or rarely exposed from the inner side due to a bad functioning from the filters, fans and ducting system connected to the proper module.

The high temperature that that is applied to these particles create marks which are difficult to remove to the point of modifying the quality of the glass and thereby the quality of the irradiance procedure.

Daily and weekly proactive maintenance can be done but due to the small size from these particles a visual operator inspection is not enough. The accumulation of these particles can make affected spots wide enough to create functional issues into the system.

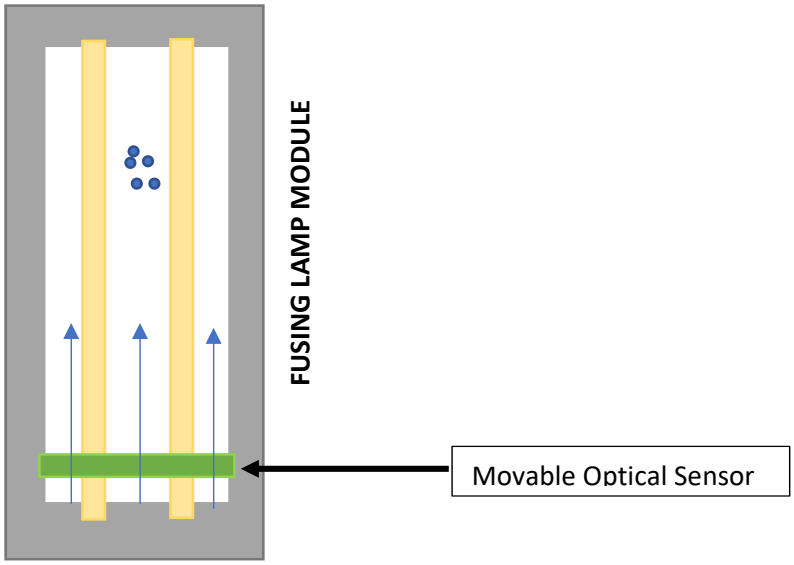
A good maintenance and glasses quality is necessary for an optimal fusing lamp calibration and best printing process.

The system itself can detect and identify the apparition of particles which could lead to some of the already commented problems. Thanks to the help of an optical sensor these particles or burnt

spots can be detected prior printing process. A movable element containing the sensor could do an inspection pass through the whole module length.

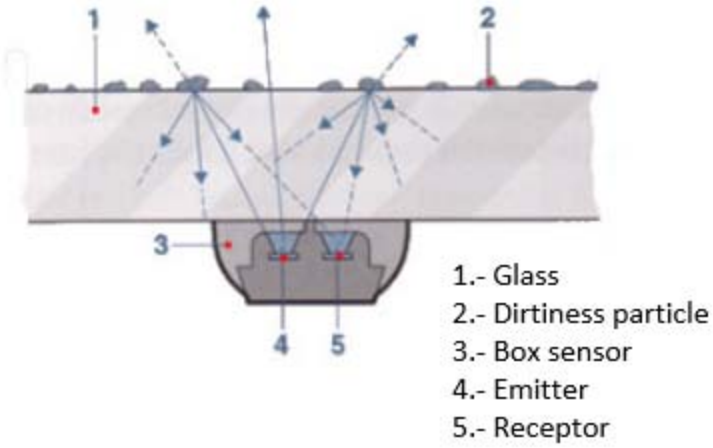
Powder accumulations can be set up as thresholds depending on the affected area and number of particles.

This check can be performed before printing in each job. This way the customer could be sure that part quality is not going to be affected by thermal spots on each one of the modules. A maintenance and inspection check could be implemented into the printer without need of printing to verify the glasses and modules health.



The proposed sensor is commonly used in the automotive industry as dirtiness sensor for headlights and similar than rain sensor.

This kind of sensor (there is a picture below for reference), detects the dirtiness amount in the glass, if this dirtiness value is above the threshold, we can prevent the customer that a cleaning is needed to not affect the Part Quality outcome.



The optical reflection cell of the sensor consists of a light source (LED) and a light receiver (phototransistor). It is located on the inner side of the glass, but not in the direct optical path. If the glass is clean, the radiant measuring beam in the vicinity of the infrared spectrum passes unimpeded to the outside. Only a tiny part of the beam is reflected in the light receiver. However, if the light beam strikes the outer surface of the glass on dirt particles, an amount of light proportional to the degree of dirt is reflected in the receiver and from a certain amount that automatically trigger the alert to the customer.

Which are the advantages on doing in this way?

- Module glasses health check and verification prior printing
- Maintenance operation for glasses status
- To assure best possible quality regarding to energy and irradiance distribution
- To avoid bad calibration processes due to bad modules maintenance
- To detect possible powder leakages coming from unexpected areas (fans, filters deterioration) directly affecting to the modules life and functioning.
- The user does not need to proactively check the glass, the system will advise if any maintenance is needed

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