ABSTRACT

Siemens production center includes an automated dyeing system used in the surface treatment of steel and copper parts. The dyeing process involves the dispatching of the parts to the system, degreasing, cleaning, phosphating, painting (powder coating), heating, cooling using a conveyor system and lastly removal of the parts from the system. The project aims increasing the throughput rate by improving the steps of the dyeing process.

OBJECTIVES

- The main objective of the dyeing process is to reduce the cycle time by various operations.
- Currently cycle time of the automated coating process is around 2 hours 25 minutes. Only way to reduce this cycle time is to increase conveyor speed which depends on some sub-operations such as heating and dyeing.
- Siemens expects a huge amount of increased demand currently and much more in the upcoming months, so improving the process by decreasing cycle time is highly significant for them.
- 3 different types of optimization processes exist; Ergonomic Improvements, Machine/Line Optimizations, and Nanotechnology Optimizations. Also, recommendations will be stated to increase overall effectiveness in the dyeing process.

PROJECT DETAILS

- Siemens production center includes an automated dyeing system used in the surface treatment of steel and copper parts.
- The dyeing process involves the dispatching of the parts to the system, degreasing, cleaning, phosphating, painting (powder coating), heating, cooling using a conveyor system and lastly removal of the parts from the system.
- The project aims increasing the throughput rate by improving the steps of the dyeing process.

It is possible to decrease the cycle time by increasing the speed of the conveyor. There are some trade-offs when the conveyors speed is increased. Increased speed of conveyor affects baths, heating, cooling, and coating stations of the process.

Nanotechnology Experiments

- The analysis was made for the dye to check within which ranges of temperature the dye dries and the analysis is called DSC (Differential Scanning Calorimetry).

Machinery (Conveyor/Line) Optimization

- The speed of the conveyor depends on the duration of each process: degreasing, cleaning, phosphating, painting (powder coating), heating, cooling.
- The current speed of the conveyor is 2 meters/minute and the speed can be increased up to 10 meters/minute depending on the maximum speed that the processes can have.

Ergonomic Test Design

- Ergonomic risks exist for the workers during the hanging process of the parts.
- The objective is to decrease this risk of injury by finding alternative solutions for the lifting state.

Test Design for Plant Utilization

- The plant utilization can be made by scheduling the parts which requires same colored coat to be hang together. The system can be scheduled in a way that the process does not stop during the day.

CONCLUSIONS

- The temperature when the dye starts to absorb the heat is 75°C and until 135°C dye continues absorbing the heat. However, after the heat increases close to 200°C, this heat transition stops to continue for 4-5 minutes. It means that all the bonds have been formed and the dye is adhered. Hence, there is no requirement for the material to be heated after 4-5 minutes in the heating process. Current duration is 7.5 minutes but experiments show that this duration can be reduced to 4 minutes.
- In the baths, the chemical density can be increased according to the increased conveyor speed. Hence, pressure of the spray can be increased in order to tolerate the increased speed. However, when the pressure is increased the parts can fall down due to that precautions are required to be taken.

REFERENCES

- “Böyahane Prosesi” Document made and shared by Siemens
- “Böyahane” Document made and shared by Siemens