Production process development of a polymer production line

In a competitive and global world, continuous overviews and assessments are required. In order to meet customer demands, quality assurance is of the highest priority and today's modern technology enables this process to be automated.

The objective is to identify and realize an improvement in the current production system. The final result is to be suited for implementation as well as take into account future scenarios, for example an increase in demand, new products and future technologies. To achieve this, an investigation of the current production system is conducted to revel an area of improvement which has to be considered in terms of cost, performance and a lean perspective.

The bottleneck of the polymer production is identified as the manual quality inspection, where salary cost is the major cost driver. It also shows that the manual quality inspection has reached a lower time limit at which it is possible to inspect the product, thus limiting the overall production capacity.

Following these conclusion the possibility of automating the in-line quality inspection is studied. In order to not inflict on quality, while inspecting for three types of defects: cracks, surface and geometry defects, technologies within non-destructive testing is investigated.

Due to material properties and required accuracy, the investigated technologies are: vision, laser, computer tomography (CT), ultrasonic, and leakage testing. Tests conducted together with possible suppliers show that cracks are difficult to detect, and especially difficult to automate the detection of due to the complexity of the material. On the other hand surface and geometry defects can be detected by CT, vision and laser. Defects located on the inside are, however, only detectable by CT.

Each of the technologies is evaluated based on four criterias: the ability to detect sought defect, capital expenditure, scalability and flexibility. The impact of each technology, in terms of the ability to detect sought defects and capital expenditure is illustrated in figure 1 below.

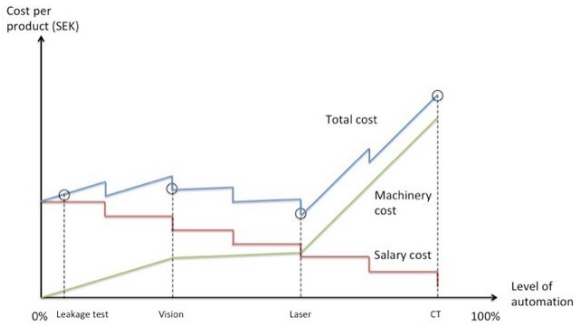

Figure 1. Total cost per product versus level of automation (number of detectable defects).

The results of the study are:

- CT has the ability to detect the highest number of defects but show a low scalability together with a high cost, and is therefore not a suitable solution.
- Leakage testing can only detect a few defects and has a low flexibility. It therefore has a limited effect on the quality inspection.
- Vision and laser both have a high flexibility and scalability, as well as relatively low capital expenditure.

The conclusion is that only vision and laser have the potential to lower the production cost and can lead to an approximately 50% automated quality inspection.