

Industry 4.0: Drivers and solutions for chemistry

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Industry 4.0 means the fourth industrial revolution using elements of the digital world for future manufacturing concepts. The main driver for Industry 4.0 is the increased pressure towards competitiveness and manufacturing productivity. The rapid increase in cross-border movement of goods, services, technology and capital leads to the emergence of a global market. The challenge is to push the main parameters for competitiveness to a new global level. Industry 4.0 for Chemistry addresses four main areas for increasing the competitiveness: 1. Reduction of times, for example by reducing processing times or development times, 2. Quality, for example achieved by a better control of critical process parameters, 3. Resources, for example by higher yields and therefore less raw materials and 4. Costs, for example by a reduced manpower demand on the plant.

Industry 4.0 and continuous manufacturing have same aims, but the toolbox is different. Therefore a synergetic effect can be generated by using both kind of tools to reach the performance targets.

Crosslinking with suppliers enable a change in the chemical value chain by using modified business models, by implementing feedback loops and by shifted responsibilities. Knowledge-based processing. Continuous processing enables two fundamental things: first a much better control of parameters allowing the same conditions for all molecules and second new strategies can be applied, which are not possible in batch. Furthermore mass and heat transfer distances can often be reduced by a magnitude moving processing times from hours to minutes for example in formulations.

Process excellence means to understand how the product quality is influenced by the process and the way of its execution. The key to success is to build a model which describes the connection of the critical quality attributes (CQA) to the critical process parameters (CPP) on a cause-effect-base. This knowledge enable a technology selection. A right-first-time philosophy pushes the focus to the chemical reaction and reduces workup effort. It is expected that modular and flexible continuous operating manufacturing plants with a high automation level will be the backbone in chemical manufacturing. A minimum of labour demand enable European and American com-

panies to compete with the Far East. Small reaction volumes and a precise control will increase the safety and efficiency level of chemical manufacturing.

New business models generate new business opportunities. For example on-demand-manufacturing and pay-per-use business models could be an option.

The conclusion of the presentation will demonstrate the business game changing effect of Industry 4.0. Industry 4.0 delivers a significant new impact for the future competitiveness of processing companies. It will be demonstrated that classical cost advantages like plant operator wages will become less important, since new success factors rise. The ability to transform will be an important success factor in the future. New business models will rise. The choice of the business model will be a permanent dynamic procedure, while in the past business models last for decades. Industry 4.0 will be a game changer for the processing industries. The speed of implementation will generate a significant advantage in respect of its competitiveness.