

Inline process monitoring

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The rubber processing industry is facing significant challenges as increasingly strict environmental regulations and a rising CO₂ price demand a reduction in production waste, while soaring energy prices continue to drive up costs.

Digitalisation can provide solutions but also presents new challenges: The intelligent analysis of measurement and production data is crucial for efficient manufacturing. However, the increasing volume of data makes it more difficult to maintain an overview and respond quickly to production errors.

Meanwhile, qualified employees with expertise in data analysis and production process monitoring are hard to find.

To address these issues, HF Group is further developing its Advise mixing room control system with the introduction of 'inline process monitoring' (IPM) – an intelligent data evaluation tool designed to monitor the mixing process and support process and production engineers in supervising the mixing room.

Advise is a flexible, modular automation system, designed to automate the entire mixing room process. It manages key stages, including raw material handling, automated weighing of components, the design and control of the mixing process, downstream equipment, and the storage of compounds.

The system is scalable, allowing for the integration of individual applications based on specific requirements, and also enables process data evaluation of mixing, machine and weighing data.

As an extension to the Advise system, the IPM application is designed to allow users to monitor production in the mixing room and quickly identify anomalies during the upstream (eg weighing of fillers), mixing and downstream (eg



The IPM application illustrates a temperature curve that is outside the tolerance due to a malfunction in the temperature control unit, while a detailed report is generated listing all out-of-tolerance conditions for a production order

extrusion) process.

By detecting issues as early as possible, it helps reduce the amount of off-spec material produced. Additionally, it supports process and production engineers by easing their supervisory tasks, enabling them to focus on optimizing production processes for greater efficiency and quality.

How it works

1. Data collection: Initially, relevant measurement values from the mixing process are collected. This data includes historically recorded process parameters and recipe values that represent the target state. Only data from processes where the material quality has been tested and confirmed satisfactory will be selected. Any data or processes deviating from this standard will be manually excluded from the dataset.

2. Master curve creation: Using the collected data, a master curve is created for each parameter. This is then assigned to the specific recipe and stored. Master curves can be created for parameters, such as main drive power, material temperature or specific energy.

3. Tolerance configuration: For each master curve, a tolerance interval is defined, allowing precise configuration for each process step

and measurement parameter. The tolerance interval and master curves are connected and stored with a specific recipe.

4. Analysis and feedback: During the mixing process, all parameters are continuously analysed and compared with the master curve and the defined tolerance interval for the recipe. If any anomalies are detected, feedback is provided to the operator and/or supervisor.

Conclusion

The IPM application enhances the Advise system by enabling monitoring of the mixing process and early detection of anomalies. By collecting historical mixing process data, creating master curves for key parameters, and defining tolerance intervals, the system ensures continuous comparison of production data against predefined benchmarks.

If deviations occur, reports are provided to operators and supervisors, allowing for quick corrective action. Examples of such deviations include malfunctions in filler or oil weighing systems, variations in raw material quality, or issues with mixer temperature control. Additionally, off-spec material can be immediately identified and separated, preventing it from entering further production steps.