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ONLINE MONITORING AND OPTIMIZATION OF REACTIVE EXTRUSION PROCESSES

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Online analysis has been widely developed to monitor the chemistry or the physics on batch or continuous processes. One of the major issues concerns the sampling part to integrate the analytical solution into the process. Optical spectroscopy is one of the most used technologies as it can be implemented directly inline and does not necessary required a sampling loop to adapt the process to the analyzer. The main advantage is the possibility to use probes or flow cells that can be immerged directly into the process. A wide range of probes exists to be able to fit with the process conditions like the temperature, pressure, or rotation speed. The possibility of using optical fibers allows to deport the analyzer from the processes to protect the sensitive part of it.
In the case of reactive extrusion processes, online analysis is not commonly used as the constraints have some difference from the classical batch or continuous processes. Harsh conditions like high temperature and pressure, melt product with high viscosity make sampling part challenging. Optical spectroscopy can monitor most of the reaction done inside an extruder and the objective here is to present how optical spectroscopy probes can be implemented directly inline. Reactive extrusion like grafting onto a polymer, depolymerization or even homogeneous mixing of polymers are presented to demonstrate its interest.
Online analysis into extruder can be used to do optimization of the process conditions to find the best quality product. An approach using near infrared spectroscopy, chemometrics tools like the PCA (Principal Component Analysis) and a design of experiments based on Bayesian optimization is also presented here. This approach allows to put in place self-optimization of the processes.

Type of presentation

Contributed Talk

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