Online Moisture Analysis of Heterogeneous Material Flows

Moisture in materials can affect performance, quality, reproducibility or cost of a manufacturing process. It is important to quantify the feed moisture at initial stages to adjust process set points accordingly, provide timely feedback and ultimately ensure a better quality product. Primary moisture measurements such as Karl-Fisher titration or gravimetric analysis are more accurate but generally time consuming. It is difficult to implement them in processes where the materials are displaced continuously. Additionally, such measurements are discrete and do not capture variations within the feed with enough resolution. Online moisture techniques provide an alternative solution to this issue. Several online moisture technologies are available in the market today. These sensors are very useful to determine moisture of homogenous materials accurately, within their calibrated limits.

Identifying a proper online moisture technique that is a good fit for recycling and mineral processing industries from the existing methods is challenging. Online sensors are highly sensitive to variations in physical properties of solid materials such as density, size, shape and hygroscopicity. If the materials contain metallic, magnetic materials or salt impurities, the measurement process is further complicated. A common lack of acceptance has been observed in metallurgical process industries because of wide varieties of feedstock materials in use that are inhomogeneous in nature. More investigation is required to find a reliable solution that is less influenced by the feed's physical properties.

This project researched finding a more common method for determining moisture content of heterogeneous material flows typical to recycling processes. The first phase of the work will be dedicated to finding the most applicable technology for determination of moisture in heterogeneous materials. The project focused on determining moisture content (1% – 20wt.% $H2O$, ± 0.1 wt.%) within typical battery scrap blends.

Action points:

- Select and test a remote moisture sensor
- Setup sensor calibration standards for wide range of materials and compositions
- Establish analytical relationships to compensate bulk density affects, flow level variations
- Design a working prototype on a conveyor belt model to test moisture contents in static and dynamic modes

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