BOS or AOD Converter

In general two converter types can be encountered, depending on the product made. On the one hand there's the BOS (Basic Oxygen Furnace Steelmaking), on the other hand one can encounter the AOD (Argon Oxygen Decarburization) route. In both types of reactors initial steel is purified and its composition optimized by adding gasses (oxygen, argon) and/or other substances such as lime. In this stage a lot of the final properties of the material are defined..

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Bearing health

The bearings are used mainly for tilting the vessel in pouring and filling operations. Specific is the fact that they in general do not rotate a full 360° and that, compared to classical bearings in motors and pumps, they rotate at low speed. This makes a classical follow-up based on vibration spectra impossible. Combining (acoustic) high-frequency data of vibrations in multiple directions with information about the operational status of the installation, damage can be detected when in an early stage of development. Also operations or conditions having a detrimental impact on the lifetime of the bearing can be identified and subsequently avoided or modified.

Gearbox health / Tilt drive

The tilting system needs to make an enormous mass move in a controlled and safe way. By combining acceleration data in multiple directions at high and low frequencies in multiple locations on the asset with data related to the process such as flow rates and angles, the state-of-health of the tilt drive can be closely monitored. Developing damage is detected in an early stage.

Process dynamics, quality and deviations

To track the efficiency of the process and to see how material properties and process parameters influence it, mass balances represent an essential piece of information. By instrumenting the base structure of the converter as well as the feeding system and internal transport tools in a smart way, one can continuously monitor this balance. Combining this with operational data from the local data Historian, the process can be improved significantly.

Foundation integrity

Different foundation designs exist, but all rely on a combination of concrete and/or steel that matches the site layout and processes and at the same time ensures stability over a long time. Monitoring vibrations and deformations continuously allows detecting deformations or damage in an early stage and will provide insights into these combinations of operational parameters that lead to accelerated degradation. Conditions, like blocked bearings, that lead to extensive loading are identified early on.

Impact of gas flows on system dynamics

The conversion process is influenced by various operational parameters like composition of the primary material and slag, gas flow rates, temperatures... Tracking all relevant parameters allows building up models linking gas flow rates and material properties with structural vibrations in multiple axis on structural components. By comparing actual measurements with expected values based on an asset-specific model, deviations in structural behavior related to gas flow can be detected in an early stage.

(Trunnion) ring health

The ring is key in making sure the vessel can make its tilting movements. Often however cracks occur in the ring, resulting in worries and cumbersome investigations. In a number of cases these cracks are caused by dynamic loads. The dynamic monitoring presented here can identify these cases where the system dynamics cause stress concentrations that can impact crack initiation and growth, an important parameter to limit or prevent them from occurring.

Damping performance

Many systems are equipped with a dynamic or parametrisable damping system. After an initial configuration, their performance is often not followed-up very closely. Using the acceleration data already recorded and used to monitor for process deviations one can also launch an additional set of algorithms to monitor continuously if the desired damping is still reached or if the system needs to be optimized, and how. Deviations are identified in an early stage, before progressive damage is done.

Impact of vessel or lining on integrity

The way the entire reactor vibrates, hence also the forces exerted on the different components like bearings and foundations, is also related to the converter vessel itself. If the vessel gets deformed and/or if the lining lay-out or adhesion resulted in a modified mass balance, this will result in a different dynamic behavior. In the worst case this leads to excessive loads on bearings, or higher deformations on the foundation, leading to a shortened operational life, or even unexpected standstills due to structural damage. Following up system dynamics continuously using a dedicated algorithm allows detecting such situations in an early stage after vessel change or re-lining and limit their impact significantly.

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