Holistic lab-to-field approach to improve screen tribo-design in steel production

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In steel production processes size fraction separation of various raw materials is essential. To maintain efficient blast furnace operation, for example, sinter material below a certain size range needs to be excluded. Thus, following the sinter production, hot sinter screens are applied to limit the feed size range. Screened fines are recycled and processed into the sintering production again.

Main goals of this work were to improve the overall performance and optimize life cycle costs of screening processes, herein exemplarily applied for the hot sinter screen. In a first step, the operating system was thoroughly examined. Detailed investigations of the wear mechanisms including material analysis as well as temperature measurements were followed by long-term monitoring of the wear propagation at the screen aperture edges using silicone replica imprints.

Since stable screening performance requires high stability of the opening width, focus was put on blunting and the overall wear behavior of the edges. Untreated original edges were investigated for wear behavior through cyclic impact/abrasion testing (CIAT) and erosion testing (ET). The wear behavior of alternative hardfacing materials were examined through CIAT using either quartz sand or steel balls. Furthermore, high temperature erosion experiments were conducted at RT, 300°C and 500°C. Results from both test methods indicate tool-steel type hardfacings for the highly loaded edges of the screens.

Promising alloys were applied in several field trials at real operating conditions. Various improvements to the original systems could be proposed and lead to significant performance enhancement, substantial lifecycle extension and hence, overall cost reductions. These improvements include a reduction of the overall number of screen apertures and lower energy consumption through less total weight after applying reduced layer and substrate thicknesses. Additionally, improved wear behavior and edge stability could reduce edge bursts and clogging as well as, eventually, at least fourfold increased the sinter screen service life.

Keywords: Lab-to-field, Tribo-design, screening process, edge stability, impact-abrasion wear

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