Abrasive wear protection in material handling: mechanism-based combination of lab-experiments for optimal material selection

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Material processing of loose goods can be found ubiquitously in heavy industries such as steel production. In transportation, relocation or other processing routines of material severe stresses are applied on machine components such as e.g. wear plates or excavator clamshells and grabs. Major wear occurrences mainly derive from dominant impact and abrasive wear mechanisms.

Substantial wear loss limits the service life of handling machinery of various raw materials and recyclables. Since operational parameters such as temperature and intensity of the tribological contact vary significantly, numerous different wear protection solutions can be implemented depending on the application. Therefore, the objectives of this work were to identify wear mechanisms for several distinct applications and evaluate the suitability of applied wear solutions. Various forms of impact and abrasive wear were simulated in lab experiments. For testing purposes a variation of ten materials consisting of several martensitic steels along with a variety of hardfacings was applied in standard G65 abrasion tests, as well as in adapted experiments for high temperature and high stress situations. Additionally, continuous impact-/abrasion-testing (CIAT) was used for examination of impact-based wear phenomena. Thereto, original abrasives from field applications were utilized. Post-test evaluations of loaded zones by 3D-microscopy and metallography produced significant insight and in-depth understanding of occurring wear processes.

An application-oriented combination of wear results was used for qualified selection of most favorable wear protection solutions for specific wear components. Applied solutions could be adapted and wear resistance substantially increased for contrasting applications such as small particle abrasion or high energy impact at different temperature ranges.

Keywords: impact, abrasive wear, material handling, wear mechanisms, wear protection

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