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Coal characteristics that lead to abrasion during grinding

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Abstract

Currently in South Africa there is no acceptable standard method for testing coals for abrasion. Abrasion is the tendency of coals to wear away machinery. The technique referred to as YGP (Yancey, Geer and Price), proposed and accepted in 1951, is most commonly used to test for abrasion. Over the years there have been some modifications to this method by both mining houses and coal users (such as Eskom) which have resulted in inconsistent and conflicting results. To this end, this study serves as part of a larger project that will aim at devising a standard method acceptable for testing coals for abrasion in South Africa. The underlying principle behind this research was to determine the main characteristics in South African run of mine (ROM) coals that may cause abrasion. This research work specifically seeks to: (1) determine if the Abrasion Index (AI) and Hardgrove Grindability Index (HGI), empirical correlations, developed by Scieszka (1985), can be verified using experimental results; (2) determine if excluded minerals and included minerals are equally abrasive; (3) establish the type of abrasive wear that occurred during coal grinding.

Five ROM coals from the Witbank Coalfields were analysed. An abrasion index tester pot and Hardgrove machine were used to determine the grinding properties of the coal samples. XRD (Rietveld method), XRF, Petrography and SEM-EDS were used to characterise the coals samples in terms of their inorganic and organic components. SEM-EDS was also used for the particle morphology analysis, and blade surface topography analysis. TGA, moisture oven and sieve method were used for proximate analysis, moisture analysis, and particle size distribution analysis respectively.

The results indicated that the key characteristics that influenced the AI of the coal samples were moisture, vitrinite, and minerals and mineral associations (excluded and included minerals and carbominerite) and HGI. Results indicated that coal weathering renders coals less abrasive, compared to unweathered coals. It was concluded that AI and HGI are experimentally dependent; excluded and included minerals were equally abrasive; and three-body abrasive wear was established to be the main wear during grinding in an abrasion index tester pot.