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The technical evaluation of non-coking coals in the production of semi-coke

Brijball, Jayshree Kalyanchad

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Abstract

Grootegeluk Coal Mine produces a metallurgical non-coking coal that is used in the production of semi-coke. Semi-coke is a new product that is used as a reductant in ferrochrome furnaces. The Exxaro semi-coke is of a high quality and is able to substitute the locally produced market coke due to its comparable (and better) strength and reactivity indexes.

This research was started to better understand the Exxaro semi-coke and the competitive advantage that comes from the single coal source in the production of semi-coke. In addition, it is important to understand if there are any other non-coking coals available in the Witbank and Highveld coalfields that can produce a similar product and replace Exxaro as a market leader.

Coals were selected from the Waterberg, Witbank and Highveld coalfields. These coals were then subjected to proximate testing and full petrographic analysis before being "charred" mimicking actual production parameters. The "charred" coals were then evaluated using petrographic analysis to better understand their inherent structures and their role in CSR and CRI.

It was found that the vitrinite reflectance of the selected coals were in a very close range of 0.67 - 0.69. It could be found that a suitable semi-coke with comparable CSR and CRI indexes could be produced from 6 of the 8 samples sourced from the Waterberg, Witbank and Highveld coalfields. However, the requirement for a substantial low phosphorus coal source will remain a barrier to entry for other potential producers of semi-coke as only minimal amounts remain.

In addition, it could be seen that semi-coke has a higher CSR than market coke due to the formation of anisotropic structures as compared to locally produced market coke that is predominantly isotropic. This ensures superior performance in the furnace

It is recommended that further work be completed to better understand the reasons for anisotropic structures in coals sourced from Exxaro. Further investigation should also be considered in utilizing coals of varying ranks in similar testing in the production of semi-coke.