DEVELOPMENT AND EVALUATION OF A DENSE MEDIA CYCLONE FOR THE SOUTHERN AFRICAN MINERAL AND COAL INDUSTRIES

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ABSTRACT

Dense media separation (DMS) plays an integral part in coal processing as well as in the upgrade of low grade ore bodies prior to further processing like flotation and leaching. Various separating vessels are used in DMS; of which the dense media (DM) cyclone is the most common. However, the limited materials of construction available for DM cyclones leave the industry with little choice. In addition, the DM cyclones available moved away from the basic principles of classification hydrocyclones which is to reduce the turbulence in the feed chamber in order to achieve improved efficiency. The ceramic tiled DM cyclones available in the market have ceramic tiles installed perpendicular to each other in the feed chamber, which increase the turbulence in the feed chamber at the expense of longer equipment life. For that reason, a research project was initiated to establish the current installed base of DM cyclones in Southern Africa and to develop and evaluate a DM cyclone with a laminar spiral feed chamber design to reduce the turbulence when feeding the cyclone, whilst achieving the same or superior wear properties.

Because Cavex is well proven in hard rock mining and coal classification, it was used as basis for the development of a DM cyclone. Individual moulds were developed and produced in order to fabricate a Cavex DM cyclone with the exact laminar spiral feed chamber that exists when moulded out of rubber. Afterwards, the Cavex ceramic tiled (CVXT) cyclone was manufactured, installed and commissioned. Using the basic operating principles of hydrocyclones, the predicted results were achieved. The 650CVXT results confirmed that a DM cyclone and a classification cyclone are inherently the same piece of equipment; it is the selection criteria and material of construction that differ. There is a definite benefit in focussing on metallurgical efficiency in conjunction with wear properties, rather than equipment life (wear life) as the only parameter during equipment fabrication. A simple way to achieve improved performance is to reduce the turbulence in the feed chamber.

Further work must include the evaluation of the Cavex CVXT DM cyclone in near gravity coal circuits and to investigate whether the same lower operating pressures (6D compared to conventional 9D) will result in improved coal yield, as was illustrated successfully in the separation of fluorspar by DMS, whilst achieving the desired ash contents. The work must include detailed studies on the effect of feed pressure vs. yield/recovery, when the turbulence in the feed chamber is reduced. Overall energy savings should be quantified by reducing the cyclone feed pressure.

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