Ultra clean coal production for the solar-cell industry

S.H. Amini

Graduate student, West Virginia University, Morgantown, WV, USA

R. Honaker

Chair and professor, University of Kentucky, Lexington, KY, USA

A. Noble

Assistant professor, West Virginia University, Morgantown, WV, USA

Background

Solar-grade silicon requires a carbon source as the primary reducing agent in the silicon production process. Ultra clean coal is a common feedstock, but residual iron from magnetite-based dense medium cleaning processes drastically reduces the purity and quality of the final silicon product. Alternative materials for the coal cleaning process are needed to meet the strict quality specifications and minimize iron contamination.

Research aim

Given that silicates are the main raw materials in silicon production, alternative silica-based materials were evaluated as substitutes for magnetites in dense medium cyclones. Residual silica on the clean coal will not interfere with silicon quality as silica is normally consumed in the production process.

Experimental

The experimental program was conducted in two phases. Initially, medium stability evaluations were

performed over a range of medium density values for various types of dense media: fine silicon, fine silica sand, ultrafine silica fume, and blends of these. Dense medium cyclone tests were then conducted to determine the separation performance and efficiency achievable when treating 9×1 mm Blue Gem seam coal.

Results

Based on the results of the medium stability study, a fine silicon suspension and a blend of fine silica sand and silica fume medium were identified as the most suitable medium materials, given their stability in a range of target medium density values. The test results (Fig. 1) show that similar DMC performances may be achieved using silica-based materials and magnetite.

Conclusion

Silica-based materials can be practically and economically applied as replacements for magnetite, the industry standard dense media for coal preparation plants, to promote the use of ultra clean coal in solar-grade silicon production.

Figure 1 — Similar performances achieved using silica-based materials (laboratory test) and magnetite (plant test).

Minerals & Metallurgical Processing, 2015, Vol. 32, No. 3, p. 188.

An official publication of the Society for Mining, Metallurgy & Exploration Inc. Copyright 2015.