Maria Holuszko, Int J Waste Resour 2018, Volume 8
DOI: 10.4172/2252-5211-C1-010

8th World Congress and Expo on Recycling

June 25-26, 2018 | Berlin, Germany

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High voltage pulse fragmentation for metal liberation from waste LED lamps

Lighting products are the most commonly used electrical products around the globe. With the improvement in lamp technologies, lighting products have grown complex. These lamps consist of various valuable metals, non-metals and traces of hazardous substances. A major step in the metal recovery process is size reduction. SELFRAG is a high voltage selective fragmentation comminution technology that uses high voltage pulses to efficiently separate the metals at coarse size as the breakage occurs along the interface/boundary thus enhancing selective comminution. Since the process utilizes a water medium, the loss of fines would be minimized and the liberation occurring at a coarser size should improve the recovery in the subsequent processes. This research looked into the applicability of high voltage pulse fragmentation for light emitting diodes (LED) lamps. Eight different types of LED lamps were processed through the SELFRAG unit at varying pulses to study metal liberation. The product obtained was characterized for metal liberation, metal grades, and liberation analysis. The specific energy consumption for this size reduction process was also monitored. The results showed that the high voltage can liberate metal at the coarser fraction without generating too much fine. With the increase in input energy, the degree of liberation for various components increased for the coarsest size fraction. On the other hand, LED lamps with metallic casing were not affected by the high voltage and hence no breakage was observed. At the same time, the energy is very high compared to the conventional crushing and grinding technology used in the mining industry.

Figure 1: Laboratory SELFRAG AG unit.

Recent Publications

1. Kumar A, Kumar V, Holuszko M and Janke T (2018) Improving the energy concentration in waste printed circuit boards using gravity separation. Recycling 3(2):21.
2. Kumar A, Holuszko M and Janke T (2018) Characterization of the non-metal fraction of the processed waste printed circuit boards. Waste Management 75:94-102.
3. Kumar A, Holuszko M and Espinosa D C R (2017) E-waste: An overview on generation, collection, legislation and recycling practices. Resources, Conservation & Recycling 122:32-42.

4. Holuszko M, Kumar A, Engwayu J, Gutierrez L and Arinaitwe E (2017) Evaluation of chemical reagents to enhance the dewatering of fine coal. International Journal of Coal Preparation and Utilization. DOI: 10.1080/19392699.2017.1327854.

5. Kumar A and Holuszko M (2016) Electronic waste and existing processing route- A Canadian perspective. Resources 5(4):35.

Biography

Maria Holuszko has more than 25 years of experience in Mineral and Coal Processing Engineering working with industry, academia, and government. Her first position was at the University of Alberta, followed by the Alberta Research Council. In the 1990s she held a Senior Licensed Scientist positon at the British Columbia Ministry of Energy in Victoria, BC and she was engaged in consulting work for the mining industry before she decided to pursue her PhD studies at UBC. After completing her PhD degree in 2006, she moved to Australia to work at the Julius Kruttschnitt Mineral Research Centre, the Center of Excellence for Mineral Processing at the University of Queensland. Currently she is working as an Assistant Professor in Mineral Processing and Urban Mining Engineering Department at University of British Columbia, Canada. Her main research interest includes Mineral and Coal Processing, Minerals and Coal Characterization, Coal and Biomass utilization, Urban Mining.

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