

Home > Journal > Earth & Environmental Sciences > JEP

[Indexing](#) [View Papers](#) [Aims & Scope](#) [Editorial Board](#) [Guideline](#) [Article Processing Charges](#)

JEP > Vol.2 No.6, August 2011

**OPEN ACCESS**

## Optimization of Precious Metal Recovery from Waste Electrical and Electronic Equipment Boards

PDF (Size: 425KB) PP. 675-682 DOI : 10.4236/jep.2011.26078

### Author(s)

Massimo Delfini, Mauro Ferrini, Andrea Manni, Paolo Massacci, Luigi Piga, Antonio Scoppettuolo

### ABSTRACT

Recovering noble metals from Waste Electrical Electronic Equipment (WEEE) will provide an additional income within the disposal process of end-of-life electronic devices. Generally, the recycling process starts with the manual dismantling of different devices and with sorting of the subdivided products into useful and hazardous materials. A sample of about 21 tonnes of WEEE was dismantled in 14 days to remove Printed Circuit Boards (PCBs) that were about 5% weight of the whole sample. Computer PCBs proved to contain the 96% of all the gold present in all types of PCBs of the sample. Computer PCBs were manually dismantled to obtain the easy-to-remove components of the board, namely, the integrated circuits and the processors, which were about 13% weight of the board and 0.1% weight of the whole WEEE sample and contained about 91% of the gold present in the whole board with an average concentration of 2400 µg/g

### KEYWORDS

WEEE, Recycling, Waste Processing, Precious Metals

### Cite this paper

M. Delfini, M. Ferrini, A. Manni, P. Massacci, L. Piga and A. Scoppettuolo, "Optimization of Precious Metal Recovery from Waste Electrical and Electronic Equipment Boards," *Journal of Environmental Protection*, Vol. 2 No. 6, 2011, pp. 675-682. doi: 10.4236/jep.2011.26078.

### References

- [1] J.-C. Lee, K. Jin-Ki, Y. Jung-II and C. Hun-Sang, " Technology for Recovering Valuable Metals from Printed Circuit Boards (PCBs) of the Used Personal Computer," *Chawon Risaikring*, Vol. 7, No. 3, 1998, pp. 58-66.
- [2] C.-H. Lee, C.-T. Chang, K.-S. Fan, C. Tien and C. Lee, " An Overview of Recycling and Treatment of Scrap Computers," *Journal of Hazardous Materials*, Vol. 114, No. 1-3, 2004, pp. 93-100.
- [3] B. Manty, N. Colon and L. Battista, " State-of-the-Art Demanufacturing of Electronic Equipment for Reuse and Recycling (Deer2)," *Proceedings of the Air & Waste Management Association' s Annual Conference & Exhibition, 93rd, Salt Lake City, 18-22 June 2000*, pp. 6095- 6104
- [4] H. Kang and Y. J. Schoenung, " Electronic Waste Recycling: A Review of U.S. Infrastructure and Technology Options," *Resources, Conservation and Recycling*, Vol. 45 2005, pp. 368-400. doi:10.1016/j.resconrec.2005.06.001
- [5] W. Z. He, G. M. Li; X. F. Ma, H. Wang, J. W. Huang, M. Xu and C. J. Huang, " WEEE Recovery Strategies and the WEEE Treatment Status in China," *Journal of Hazardous Materials*, Vol. 136, No. 3, 2006, pp. 502-512. doi:10.1016/j.jhazmat.2006.04.060
- [6] K. Feszty, C. Murchison, J. Baird and G. Jamnejad, " Assessment of the Quantities of Waste Electrical and Electronic Equipment (WEEE) in Scotland," *Waste Management & Research: The Journal of the International Solid Wastes and Public Cleansing Association, ISWA*, Vol. 21, No. 3, 2003, pp. 207-217.
- [7] A. Karagiannidis, A. Papadopoulos, N. Moussiopoulos, G. Perkoulidis, T. Tsatsarelis and A.

- [Open Special Issues](#)
- [Published Special Issues](#)
- [Special Issues Guideline](#)

[JEP Subscription](#)

[Most popular papers in JEP](#)

[About JEP News](#)

[Frequently Asked Questions](#)

[Recommend to Peers](#)

[Recommend to Library](#)

[Contact Us](#)

Downloads: 301,518

Visits: 674,008

Sponsors, Associates, and Links >>

- [The International Conference on Pollution and Treatment Technology \(PTT 2013\)](#)

Michalopoulos, " Characteristics of Wastes from Electric and Electronic Equipment in Greece: Results of a Field Survey," Proceedings of the International Conference on Environmental Science and Technology, 8th, Myrina, 8-10 September 2003, pp. B353-B360

- [8] L. Schebek, " Disposal of Electronic Scrap in Baden- Wuerttemberg: A Life-Cycle View on Future Recycling Options—Outline of a Study," Wissenschaftliche Berichte- Forschungszentrum Karlsruhe, 2004, pp. F1/1-F1/5.
- [9] R. Hischer, P. Wager and J. Gauglhofer, " Does WEEE Recycling Make Sense from an Environmental Perspective? The Environmental Impacts of the Swiss Take-Back and Recycling Systems for Waste Electrical and Electronic Equipment (WEEE)," Environmental Impact Assessment Review, Vol. 25, 2005, pp. 525-539. doi:10.1016/j.eiar.2005.04.003
- [10] S. Zhang and E. Forssberg, " Intelligent Liberation and Classification of Electronic Scrap," Powder Technology, Vol. 105, 1999, pp. 295-301. doi:10.1016/S0032-5910(99)00151-5
- [11] A. Seemann, H. Schreiber, S. Krishna and T. Radha, " Waste Recycling in India," Muell und Abfall, Vol. 40, No. 6, 2008, pp. 306-310.
- [12] T. Hainault and D. S. Smith, " Minnesota' s Multi- stakeolder Approach to Managing Electronic Products at End-of-Life," Proceeding of IEEE International Symposium on Electronics and Environment, 2000, pp. 310-317
- [13] J. K. Y. Chan, Y. Xu, Y. Liang, L.X. Chen, S. C. Wu, C. K. C. Wong, C. K. M. Leung and M. H. Wong, " Dioxin Levels in Human Specimens from Taizhou, an Electronic- Waste Recycling Site in Eastern China," Organohalogen Compounds, Vol. 69, No. 291, 2007, pp. 1-3.
- [14] G. H. Xing, K. Y. C. Janet, O. W. L. Anna, C. W. Sheng and M. H. Wong, " Environmental Impact and Human Exposure to PCBs in Guiyu, an Electronic Waste Recycling Site in China," Environment International (2008), Vol. 35, No. 1, 2009, pp. 76-82.
- [15] L. Chen, J. X. Guo, Z. Z. Yu, J. Ying, B. S. Ji, J. Qi, P. L. Li, J. Jing, C. W. Tang and M. C. Xue, " Levels of Lead, Cadmium, Copper in Blood and urine And Frequencies of Micronucleated Binucleated Cells among Residents in an Electronic Waste Recycling Site in China," Huanjing Yu Zhiye Yixue, Vol. 25, No. 5, 2008, pp. 442-445.
- [16] Y. Li, H. Xia, K. Z. Liang, Z. Bao, J. C. Gang, W. G. Cheng, X. L. Jun, J. C. Song and J. X. Xi, " Umbilical Cord Blood Chromium Level of Newborns in Electronic Waste Recycling Area," Aibian, Jibian, Tubian, Vol. 19, No. 5, 2007, pp. 409-411.
- [17] S. X. Liang, Z. Qian, F. O. Zhan, R. Z. Xing, Z. Y. Zhong and B. X. Xiao, " Levels and Distribution of Polybrominated Diphenyl Ethers in Various Tissues of Foraging Hens from an Electronic Waste Recycling Area in South China," Environmental Toxicology and Chemistry, Vol. 27, No. 6, 2008, pp. 1279-1283. doi:10.1897/07-518.1
- [18] W. J. Deng, P. K. K. Louie, W. K. Liu, X. H. Bi, J. M. Fu and M. H. Wong, " Atmospheric Levels and Cytotoxicity of PAHs and Heavy Metals in TSP and PM2.5 at an Electronic Waste Recycling Site in Southeast China," Atmospheric Environment, Vol. 40, No. 36, 2006, pp. 6945- 6955. doi:10.1016/j.atmosenv.2006.06.032
- [19] N. Menad and B. Bjorkman, " EPD Congress, Nashville, Tennessee," The Mineral Metals & Materials Society, 2000, pp. 231-243.
- [20] S. Kitamoto, K. Yonezu, H. Ohashi, Y. Motomura, Y. Kobayashi, Y. Okaue, A. Miyazaki, K. Watanabe and T. Yokoyama, " Coprecipitation of Au(III) Complex Ions with Iron(III) Hydroxide and Their Spontaneous Reduction," Journal of MMIJ, Vol. 123, No. 8, 2007, pp. 406- 412. doi:10.2473/journalofmmij.123.406