## References

## References

[1] CSO., "First Advance Estimates of National Income, 2016-17", Report: Ministry of Statistics and Programme Implementation, New Delhi, India, 2017.

[2] CSO., "Advance Estimates of National Income, 2013-14", India, Report: Ministry of Statistics and Programme Implementation, New Delhi, India, 2014.

[3] World-Bank., "Digital Dividends", Report: World Bank, Washington D.C., USA, 2016, pp 1-58.

[4] Meeker M., "Internet Trends", Report:K leiner Perkins Caufield Byers, United States, 2012.

[5] Pichtel J., Waste management practices, Taylor and Fransis Group, CRC press, USA, 2014.

[6] Szałatkiewicz J., Szewczyk R., Budny E., Missala T., and Winiarski W., "Construction Aspects of Plasma Based Technology for Waste of Electrical and Electronic Equipment (WEEE) Management in Urban areas", *Procedia Engineering*, **57**(2013)1100–1108.

[7] Sthiannopkao S. and Wong M.H., "Handling e-waste in developed and developing countries: initiatives, practices, and consequences.", *The Science of the total environment*, **463**–**464**(2013)1147–53.

[8] Rubin R.S., Castro M.A.S. de, Brandão D., Schalch V., and Ometto A.R., "Utilization of Life Cycle Assessment methodology to compare two strategies for recovery of copper from printed circuit board scrap", *Journal of Cleaner Production*, **64**(2014)297–305.

[9] Petridis N.E., Stiakakis E., Petridis K., and Dey P., "Estimation of computer waste quantities using forecasting techniques", *Journal of Cleaner Production*, **112**(2016)3072–3085.

[10] Chen M., Zhang S., Huang J., and Chen H., "Lead during the leaching process of copper from waste printed circuit boards by five typical ionic liquid acids", *Journal of Cleaner Production*, **95**(2015)142–147.

[11] Chen M., Wang J., Huang J., and Chen H., "Behaviour of zinc during the process of leaching copper from WPCBs by typical acidic ionic liquids", *RSC Advances*, **5**(2015)34921–34926.

[12] Ongondo F.O., Williams I.D., and Cherrett T.J., "How are WEEE doing? A global review of the management of electrical and electronic wastes.", *Waste management*, **31**(2011)714–730.

[13] Tuncuk a., Stazi V., Akcil a., Yazici E.Y., and Deveci H., "Aqueous metal recovery techniques from e-scrap: Hydrometallurgy in recycling", *Minerals Engineering*, **25**(2012)28–37.

[14] Tanskanen P., "Management and recycling of electronic waste", *Acta Materialia*, **61**(2013)1001–1011.

[15] Sum E.Y.L., "The Recovery of Metals from Electronic Scrap", *Review of Extractive Metallurgy*, **43**(1991)53–61.

[16] Ribeiro P.P.M., Guimaraes Y.F., Santos I.D. dos, and Dutra A.J.B., "Concentration of Metals from Obsolete Printed Circuit Boards (PCBs)", International Mineral Processing Symposium-2012, Bodrum, Turkey, 2012.

[17] Robinson B.H., "E-waste: an assessment of global production and environmental impacts.",

*The Science of the total environment*, **408**(2009)183–91.

[18] Veit H.M. and Bernardes A.M., Electronic Waste- Recycling Techniques, Veit H.M. and Bernardes A.M., (eds.), Springer International Publishing, Switzerland, 2015.

[19] Fogarasi S., Imre-lucaci F., Egedy A., Imre-lucaci Á., and Ilea P., "Eco-friendly copper recovery process from waste printed circuit boards", *Waste Management*, **40**(2015)136–143.

[20] Fujita T., Ono H., Dodbiba G., and Yamaguchi K., "Evaluation of a recycling process for printed circuit board by physical separation and heat treatment", *Waste Management*, **34**(2014)1264–1273.

[21] Hadi P., Ning C., Ouyang W., Xu M., Lin C.S.K., and McKay G., "Toward environmentally-benign utilization of nonmetallic fraction of waste printed circuit boards as modifier and precursor", *Waste Management*, **35**(2015)236–246.

[22] de Oliveira C.R., Bernardes A.M., and Gerbase A.E., "Collection and recycling of electronic scrap: a worldwide overview and comparison with the Brazilian situation.", *Waste management*, **32**(2012)1592–610.

[23] Kiddee P., Naidu R., and Wong M.H., "Electronic waste management approaches: an overview.", *Waste management*, **33**(2013)1237–50.

[24] Marques A.C., Cabrera Marrero J.-M., and de Fraga Malfatti C., "A review of the recycling of non-metallic fractions of printed circuit boards.", *SpringerPlus*, **2**(2013)521.

[25] Kose, M. A., The Global Economy in Transition, Report: World Bank Group., Washington D.C., USA, 2015.

[26] Blade C.P., Wang F., Kuehr R., and Huisman J., "E-waste monitor The Global E-waste Monitor", Report: United Nations University, Bonn, Germany, 2015.

[27] Causes International, "E-Waste Facts", Report: Causes International, MA, USA, 2014, pp.1–4.

[28] Dwivedy M. and Mittal R.K., "An investigation into e-waste flows in India", *Journal of Cleaner Production*, **37**(2012)229–242.

[29] Olds L., "Curb your e-waste : why the united states should control its electronic", *Cardozo Journal Of International And Comparative Law*. (2012)827-872.

[30] India P.T. of., India's telecom subscriber base at 1,198 mn in April , but Reliance Jio's additions slow down, Press Release: The Indian Express, 2017, 1–12.

[31] Dwivedy M. and Mittal R.K., "Future trends in computer waste generation in India.", *Waste management*, **30**(2010)2265–77.

[32] CPCB., "List of Registered E-Waste Dismantlers / Recyclers in the country (as on 29-12-2016)", Report: Central Pollution Control Board, NEw Delhi, India, 2016.

[33]Chatterjee, S., "Electronic Waste and India", Report: Ministry of Electronic and Information Technology, India, 1-15

[34] Wong M.H., Wu S.C., Deng W.J., et al., "Export of toxic chemicals - a review of the case of uncontrolled electronic-waste recycling.", *Environmental pollution (Barking, Essex : 1987)*, **149**(2007)131–40.

[35] Duan H., Li J., Liu Y., Yamazaki N., and Jiang W., "Characterization and inventory of PCDD/Fs and PBDD/Fs emissions from the incineration of waste printed circuit board", *Environmental Science and Technology*, **45**(2011)6322–6328.

[36] Lai Y.C., Lee W.J., Li H.W., Wang L.C., and Chang-Chien G.P., "Inhibition of polybrominated dibenzo-p-dioxin and dibenzofuran formation from the pyrolysis of printed circuit boards", *Environmental Science and Technology*, **41**(2007)957–962.

[37] Duan H., Li J., Liu Y., Yamazaki N., and Jiang W., "Characterizing the emission of chlorinated/brominated dibenzo-p-dioxins and furans from low-temperature thermal processing of waste printed circuit board", *Environmental Pollution*, **161**(2012)185–191.

[38] Till M., Behnisch P., Hagenmaier H., Bock K.W., and Schrenk D., "Dioxinlike components in incinerator fly ash: A comparison between chemical analysis data and results from a cell culture bioassay", *Environmental Health Perspectives*, **105**(1997)1326–1332.

[39] Fiedler H., Dioxins and Furans (PCDD/PCDF), , The Handbook of Environmental Chemistry. H.Fiedler, (ed.) Springer-Verlag, Berlin, 2003, 123–201.

[40] Jin Y., Tao L., Chi Y., and Yan J., "Conversion of bromine during thermal decomposition of printed circuit boards at high temperature.", *Journal of hazardous materials*, **186**(2011)707–12.

[41] Moltó J., Egea S., Conesa J.A., and Font R., "Thermal decomposition of electronic wastes: Mobile phone case and other parts", *Waste Management*, **31**(2011)2546–2552.

[42] Chan J.K.Y. and Wong M.H., "A review of environmental fate, body burdens, and human health risk assessment of PCDD/Fs at two typical electronic waste recycling sites in China.", *The Science of the total environment*, **463–464**(2013)1111–23.

[43] Kampa M. and Castanas E., "Human health effects of air pollution.", *Environmental pollution (Barking, Essex : 1987)*, **151**(2008)362–7.

[44] Gaidajis G., Angelakoglou K., and Aktsoglou D., "E-waste : Environmental Problems and Current Management", **3**(2010)193–199.

[45] Zhang T., Huang Y.-R., Chen S.-J., et al., "PCDD/Fs, PBDD/Fs, and PBDEs in the air of an e-waste recycling area (Taizhou) in China: current levels, composition profiles, and potential cancer risks.", *Journal of environmental monitoring*, **14**(2012)3156–63.

[46] Wang R. and Xu Z., "Recycling of non-metallic fractions from waste electrical and electronic equipment (WEEE): A review", *Waste Management*, **34**(2014)1455–1469.

[47] "E-Waste in India", Report: Secretariat, Rajya Sabha, New Delhi, India, (2011)122.

[48] Chi X., Streicher-Porte M., Wang M.Y.L., and Reuter M. a., "Informal electronic waste recycling: a sector review with special focus on China.", *Waste management (New York, N.Y.)*, **31**(2011)731–42.

[49] Sahni S.K., "Hazardous metals and minerals pollution in india: sources, toxicity and management", Report: Indian National Science Academy, New Delhi, India, 2011, 1-29.

[50] Mallampati S.R., Heo J.H., and Park M.H., "Hybrid selective surface hydrophilization and froth flotation separation of hazardous chlorinated plastics from E-waste with novel nanoscale metallic calcium composite", *Journal of Hazardous Materials*, **306**(2016)13–23.

[51] Baruthio F., "Toxic effects of chromium and its compounds.", *Biological trace element research*, **32**(1992)145–153.

[52] ETBC., "Facts and Figures on E-Waste and Recycling", Report: Electronic take back coalition, Oakland, California, 2013.

[53] ETBC., "Facts and Figures on E-Waste and Recycling", Report: Electronic take back coalition, Oakland, California, 2016.

[54] Zeng X. and Li J., "Measuring the recyclability of e-waste : an innovative method and its implications", *Journal of Cleaner Production*, **131**(2016)156–162.

[55] Man M., Naidu R., and Wong M.H., "Persistent toxic substances released from uncontrolled e-waste recycling and actions for the future.", *The Science of the total environment*, **463–464**(2013)1133–7.

[56] Ghosh B., Ghosh M.K., Parhi P., Mukherjee P.S., and Mishra B.K., "Waste Printed Circuit Boards recycling: An extensive assessment of current status", *Journal of Cleaner Production*, **94**(2015)5–19.

[57] Bernardes A., Bohlinger I., Rodriguez D., Ha M., and Wuth W., "Recycling of printed circuit boards by melting with oxidising/reducing top blowing process", Sessions and Symposia Sponsored by the Extraction and Processing Division, TMS Annual Meeting, USA, 2007, pp. 363–375.

[58] Basdere B. and Seliger G., "Disassembly Factories for Electrical and Electronic Products to Recover Resources in Product and Material Cycles", *Environmental Science and Technology*, **37**(2003)5354–5362.

[59] Guo X., Qin F.G.F., Yang X., and Jiang R., "Study on low-temperature pyrolysis of largesize printed circuit boards", *Journal of Analytical and Applied Pyrolysis*, **105**(2014)151–156.

[60] Gurung M., Adhikari B.B., Kawakita H., Ohto K., Inoue K., and Alam S., "Recovery of gold and silver from spent mobile phones by means of acidothiourea leaching followed by adsorption using biosorbent prepared from persimmon tannin", *Hydrometallurgy*, **133**(2013)84–93.

[61] "NEMA Grade FR4 Glass Epoxy Laminate- Material datasheet", Reprort: The Gund company, Inc. USA, 2016.

[62] "Industrial Laminating Thermosetting Products", Reprot: National Electrical Manufactures Association (NEMA\_LI\_1-1998), Virginia, 1998.

[63] Xing M. and Zhang F.-S., "Degradation of brominated epoxy resin and metal recovery from waste printed circuit boards through batch sub/supercritical water treatments", *Chemical Engineering Journal*, **219**(2013)131–136.

[64] Quan C., Li A., and Gao N., "Synthesis of carbon nanotubes and porous carbons from printed circuit board waste pyrolysis oil.", *Journal of hazardous materials*, **179**(2010)911–7.

[65] Juan H., Haifeng W., Shulei S., and Xingyong W., "Status of Recycling Scrap Printed Circuit Boards by Pyrolysis", *China Resources Comprehensive Utilization*, **6**(2008)30–34.

[66] Ogunniyi I.O. and Vermaak M.K.G., "Investigation of froth flotation for beneficiation of printed circuit board comminution fines", *Minerals Engineering*, **22**(2009)378–385.

[67] Hageluken C., "Improving metal returns and eco-efficiency in electronics recycling", Proceedings of the 2006 IEEE conference, 2006, pp. 218–223.

[68] Zhao Y., Wen X., Li B., and Tao D., "Recovery of copper from waste printed circuit board", *Journal of Minerals & Metallurgical Processing*, **21**(2004)99–102.

[69] Kim B.-S., Lee J., Seo S.-P., Park Y.-K., and Sohn H.Y., "A process for extracting precious metals from spent printed circuit boards and automobile catalysts", *JOM - Journal of the Minerals, Metals and Materials Society*, **56**(2004)55–58.

[70] Iji M. and Yokoyama S., "Recycling of Printed Wiring Boards with Mounted Electronic Components", *Circuit World*, 23(1997)10–15.

[71] Kogan V., Google Patents No.WO2006013568A2, 2006.

[72] Yazici E.Y. and Deveci H., "Extraction of metals from waste printed circuit boards (WPCBs) in H 2SO4-CuSO4-NaCl solutions", *Hydrometallurgy*, **139**(2013)30–38.

[73] Han Y., He W., Li L., Li G., and Huang J., "Mathematical analysis of the gas-solid fluidized bed separation of metals and nonmetals from waste PCB powders", *Powder Technology*, **295**(2016)142–151.

[74] Zhao Y., Zhang B., Duan C., Chen X., and Sun S., "Material port fractal of fragmentation of waste printed circuit boards (WPCBs) by high-voltage pulse", *Powder Technology*, **269**(2015)219–226.

[75] Yang T., Xu Z., Wen J., and Yang L., "Factors influencing bioleaching copper from waste printed circuit boards by Acidithiobacillus ferrooxidans", *Hydrometallurgy*, **97**(2009)29–32.

[76] Duan C.L., Diao Z.J., Zhao Y.M., and Huang W., "Liberation of valuable materials in waste printed circuit boards by high-voltage electrical pulses", *Minerals Engineering*, **70**(2015)170–177.

[77] Duan C., Wen X., Shi C., Zhao Y., Wen B., and He Y., "Recovery of metals from waste printed circuit boards by a mechanical method using a water medium.", *Journal of hazardous materials*, **166**(2009)478–482.

[78] Koyanaka S., Endoh S., and Ohya H., "Effect of impact velocity control on selective grinding", *Advanced Powder Technology*, **17**(2006)113–126.

[79] Cao M., Wang P., Ao Y., Wang C., Hou J., and Qian J., "Photocatalytic degradation of tetrabromobisphenol A by a magnetically separable graphene-TiO2 composite photocatalyst: Mechanism and intermediates analysis", *Chemical Engineering Journal*, **264**(2015)113–124.

[80] Schubert G. and Bernotat S., "Comminution of non-brittle materials", *International Journal of Mineral Processing*, **74**(2004)19–30.

[81] Büyükbay B., Ciliz N., Goren G.E., and Mammadov A., "Cleaner production application as a sustainable production strategy, in a Turkish Printed Circuit Board Plant", *Resources, Conservation and Recycling*, **54**(2010)744–751.

[82] Song Q., Wang Z., and Li J., "Residents' behaviors, attitudes, and willingness to pay for recycling e-waste in Macau.", *Journal of environmental management*, **106**(2012)8–16.

[83] Zhang S. and Forssberg E., "Intelligent Liberation and classification of electronic scrap", *Powder Technology*, **105**(1999)295–301.

[84] Yoo J.M., Jeong J., Yoo K., Lee J. chun, and Kim W., "Enrichment of the metallic components from waste printed circuit boards by a mechanical separation process using a stamp mill", *Waste Management*, **29**(2009)1132–1137.

[85] He Y. and Xu Z., "Recycling gold and copper from waste printed circuit boards using chlorination process", *RSC Advances*, **5**(2015)8957–8964.

[86] Hino T., Agawa R., Moriya Y., Nishida M., Tsugita Y., and Araki T., "Techniques to separate metal from waste printed circuit boards from discarded personal computers", *Journal of Material Cycles and Waste Management*, **11**(2009)42–54.

[87] Koyanaka S., Endoh S., Ohya H., and Iwata H., "Particle shape of copper milled by swing-hammer-type impact mill", *Powder Technology*, **90**(1997)135–140.

[88] Koyanaka S., Endoh S., and Ohya H., "Effect of impact velocity control on selective grinding of waste printed circuit boards", *Advanced Powder Technology*, **17**(2006)113–126.

[89] Cui J. and Forssberg E., "Mechanical recycling of waste electric and electronic equipment: a review", *Journal of Hazardous Materials*, **99**(2003)243–263.

[90] Zhang S. and Forssberg E., "Mechanical separation-oriented characterization of electronic scrap", *Resources, Conservation and Recycling*, **21**(1997)247–269.

[91] Jiang W., Jia L., and Zhen-Ming X., "Optimization of key factors of the electrostatic separation for crushed PCB wastes using roll-type separator.", *Journal of hazardous materials*, **154**(2008)161–167.

[92] Wu J., Li J., and Xu Z., "Electrostatic separation for recovering metals and nonmetals from waste printed circuit board: Problems and improvements", *Environmental Science and Technology*, **42**(2008)5272–5276.

[93] Li J., Xu Z., and Zhou Y., "Application of corona discharge and electrostatic force to separate metals and nonmetals from crushed particles of waste printed circuit boards", *Journal of Electrostatics*, **65**(2007)233–238.

[94] Xue M., Yan G., Li J., and Xu Z., "Electrostatic separation for recycling conductors, semiconductors, and nonconductors from electronic waste", *Environmental Science and Technology*, **46**(2012)10556–10563.

[95] Hou S., Wu J., Qin Y., and Xu Z., "Electrostatic separation for recycling waste printed circuit board: A study on external factor and a robust design for optimization", *Environmental Science and Technology*, **44**(2010)5177–5181.

[96] Guo C., Wang H., Liang W., Fu J., and Yi X., "Liberation characteristic and physical separation of printed circuit board (PCB).", *Waste management*, **31**(2011)2161–21666.

[97] Cui J. and Forssberg E., "Mechanical recycling of waste electric and electronic equipment: A review", *Journal of Hazardous Materials*, **B99**(2003)243–263.

[98] Jujun R., Yiming Q., and Zhenming X., "Environment-friendly technology for recovering nonferrous metals from e-waste: Eddy current separation", *Resources, Conservation and Recycling*, **87**(2014)109–116.

[99] Zhang S., Forssberg E., Arvidson B., and Moss W., "Aluminum recovery from electronic scrap by High-Force® eddy-current separators", *Resources, Conservation and Recycling,* 

**23**(1998)225–241.

[100] Menad N., Guignot S., and van Houwelingen J. a., "New characterisation method of electrical and electronic equipment wastes (WEEE).", *Waste management*, **33**(2013)706–713.

[101] Guo J., Rao Q., and Xu Z., "Application of glass-nonmetals of waste printed circuit boards to produce phenolic moulding compound.", *Journal of hazardous materials*, **153**(2008)728–34.

[102] Jain, A.,"E-waste Volume II, E-waste Management Manual", Report: United Nations Protection Agency, USA, 2007.

[103] Eswaraiah C., Kavitha T., Vidyasagar S., and Narayanan S.S., "Classification of metals and plastics from printed circuit boards (PCB) using air classifier", *Chemical Engineering and Processing: Process Intensification*, **47**(2008)565–576.

[104] Lee C.-H., Chang C.-T., Fan K.-S., and Chang T.-C., "An overview of recycling and treatment of scrap computers.", *Journal of hazardous materials*, **114**(2004)93–100.

[105] Yin J., Li G., He W., Huang J., and Xu M., "Hydrothermal decomposition of brominated epoxy resin in waste printed circuit boards", *Journal of Analytical and Applied Pyrolysis*, **92**(2011)131–136.

[106] Ke Y., Yang E., Liu X., Liu C., and Dong W., "Preparation of porous carbons from nonmetallic fractions of waste printed circuit boards by chemical and physical activation", *New Carbon Materials*, **28**(2013)108–113.

[107] Wang H., Wang C. qing, Fu J. gang, and Gu G. hua., "Flotability and flotation separation of polymer materials modulated by wetting agents", *Waste Management*, **34**(2014)309–315.

[108] Raquel M. and Dias S., "Separation of WEEE plastics resorting gravity separation and froth flotation", M.Sc. Thesis, Technical University of Lisbon, Lisbon, Portugal

[109] Drelich J., Payne T., Kim J.H., and Miller J.D., "Selective Froth Flotation of PVC From PVC / PET Mixtures for the Plastics Recycling Industry", *Polymer Engineering And Science, September*, (9)**38**(1998)1378-1386

[110] Dey S.K., Ari V., and Das A., "Processing of electronic waste in a counter current teeterbed separator", *Journal of Environmental Management*, **107**(2012)45–51.

[111] He J.F., Duan C.L., He Y.Q., and Zhang H.J., "Recovery of valuable metal concentrate from waste printed circuit boards by a physical beneficiation technology", *International Journal of Environmental Science and Technology*, **12**(2015)2603–2612.

[112] Somasundaram M., Saravanathamizhan R., Ahmed Basha C., Nandakumar V., Nathira Begum S., and Kannadasan T., "Recovery of copper from scrap printed circuit board: Modelling and optimization using response surface methodology", *Powder Technology*, **266**(2014)1–6.

[113] Sanyal S., Ke Q., Zhang Y., et al., "Understanding and optimizing delamination/recycling of printed circuit boards using a supercritical carbon dioxide process", *Journal of Cleaner Production*, **41**(2013)174–178.

[114] Kumar M., Kumar P., Kumari A., et al., "Leaching studies for tin recovery from waste e-scrap", *Waste Management*, **32**(2012)1919–1925.

[115] Hong Y. and Valix M., "Bioleaching of electronic waste using acidophilic sulfur oxidising

bacteria", Journal of Cleaner Production, 65(2014)465-472.

[116] Murugan R.V., Bharat S., Deshpande A.P., Varughese S., and Haridoss P., "Milling and separation of the multi-component printed circuit board materials and the analysis of elutriation based on a single particle model", *Powder Technology*, **183**(2008)169–176.

[117] Danon-Schaffer M.N., Mahecha-Botero A., Grace J.R., and Ikonomou M., "Transfer of PBDEs from e-waste to aqueous media.", *The Science of the total environment*, **447**(2013)458–71.

[118] Zhou Y. and Qiu K., "A new technology for recycling materials from waste printed circuit boards", *Journal of Hazardous Materials*, **175**(2010)823–828.

[119] Kumar V., Lee J.C., Jeong J., Jha M.K., Kim B.S., and Singh R., "Novel physical separation process for eco-friendly recycling of rare and valuable metals from end-of-life DVD-PCBs", *Separation and Purification Technology*, **111**(2013)145–154.

[120] Long L., Sun S., Zhong S., Dai W., Liu J., and Song W., "Using vacuum pyrolysis and mechanical processing for recycling waste printed circuit boards.", *Journal of hazardous materials*, **177**(2010)626–32.

[121] Menad N., Bjo B., and Allain E.G., "Combustion of plastics contained in electric and electronic scrap", **24**(1998)65–85.

[122] Tai Q., Yuen R.K.K., Song L., and Hu Y., "A novel polymeric flame retardant and exfoliated clay nanocomposites: Preparation and properties", *Chemical Engineering Journal*, **183**(2012)542–549.

[123] Hall W.J. and Williams P.T., "Separation and recovery of materials from scrap printed circuit boards", *Resources, Conservation and Recycling*, **51**(2007)691–709.

[124] Liou T.H., "Pyrolysis kinetics of electronic packaging material in a nitrogen atmosphere", *Journal of Hazardous Materials*, **B103**(2003)107–123.

[125] Lin K.H. and Chiang H.L., "Liquid oil and residual characteristics of printed circuit board recycle by pyrolysis", *Journal of Hazardous Materials*, **271**(2014)258–265.

[126] Chiang H.L., Lin K.H., Lai M.H., Chen T.C., and Ma S.Y., "Pyrolysis characteristics of integrated circuit boards at various particle sizes and temperatures", *Journal of Hazardous Materials*, **149**(2007)151–159.

[127] Li J., Duan H., Yu K., Liu L., and Wang S., "Characteristic of low-temperature pyrolysis of printed circuit boards subjected to various atmosphere", *Resources, Conservation and Recycling*, **54**(2010)810–815.

[128] Rajarao R., Sahajwalla V., Cayumil R., Park M., and Khanna R., "Novel Approach for Processing Hazardous Electronic Waste", *Procedia Environmental Sciences*, **21**(2014)33–41.

[129] Muhammad C., Onwudili J.A., and Williams P.T., "Journal of Analytical and Applied Pyrolysis Catalytic pyrolysis of waste plastic from electrical and electronic equipment &", *Journal of Analytical and Applied Pyrolysis*, **113**(2015)332–339.

[130] Wu W. and Qiu K., "Vacuum co-pyrolysis of Chinese fir sawdust and waste printed circuit boards. Part I: Influence of mass ratio of reactants", *Journal of Analytical and Applied Pyrolysis*, **105**(2014)252–261.

[131] Zhou Y., Wu W., and Qiu K., "Recycling of organic materials and solder from waste printed circuit boards by vacuum pyrolysis-centrifugation coupling technology.", *Waste management*, **31**(2011)2569–76.

[132] Shaohong P., Lieqiang C., Ge G., and Mingzhao C., "Vacuum pyrolysis of waste printed circuit board", *Journal of Chemical Industry and Engineering (China)*, **57**(2006)2720–2727.

[133] Chiang H.-L. and Lin K.-H., "Exhaust constituent emission factors of printed circuit board pyrolysis processes and its exhaust control.", *Journal of hazardous materials*, **264**(2014)545–551.

[134] Barontini F., Marsanich K., Petarca L., and Cozzani V., "Thermal degradation and decomposition products of electronic boards containing BFRs", *Industrial and Engineering Chemistry Research*, **44**(2005)4186–4199.

[135] Ortuño N., Moltó J., Egea S., Font R., and Conesa J. a., "Thermogravimetric study of the decomposition of printed circuit boards from mobile phones", *Journal of Analytical and Applied Pyrolysis*, **103**(2013)189–200.

[136] Oleszek S., Grabda M., Shibata E., and Nakamura T., "Distribution of copper, silver and gold during thermal treatment with brominated flame retardants.", *Waste management*, **33**(2013)1835–1842.

[137] Hao J., Wang H., Chen S., Cai B., Ge L., and Xia W., "Pyrolysis characteristics of the mixture of printed circuit board scraps and coal powder", *Waste Management*, **34**(2014)1763–1769.

[138] Guo J., Guo J., and Xu Z., "Recycling of non-metallic fractions from waste printed circuit boards: a review.", *Journal of hazardous materials*, **168**(2009)567–90.

[139] Zhou Y., Wu W., and Qiu K., "Recovery of materials from waste printed circuit boards by vacuum pyrolysis and vacuum centrifugal separation.", *Waste management (New York, N.Y.)*, **30**(2010)2299–304.

[140] Hall W.J. and Williams P.T., "Fast pyrolysis of halogenated plastics recovered from waste computers", *Energy and Fuels*, **20**(2006)1536–1549.

[141] Quan C., Li A., Gao N., and Dan Z., "Characterization of products recycling from PCB waste pyrolysis", *Journal of Analytical and Applied Pyrolysis*, **89**(2010)102–106.

[142] de Marco I., Caballero B.M., Chomón M.J., et al., "Pyrolysis of electrical and electronic wastes", *Journal of Analytical and Applied Pyrolysis*, **82**(2008)179–183.

[143] Cayumil R., Khanna R., Ikram-Ul-Haq M., Rajarao R., Hill a., and Sahajwalla V., "Generation of copper rich metallic phases from waste printed circuit boards", *Waste Management*, (2014).

[144] Mankhand T.R., Singh K.K., Gupta S.K., and Das S., "Pyrolysis of Printed Circuit Boards", *International Journal of Metallurgical Engineering*, 1(2012)102–107.

[145] Havlik T., Orac D., Petranikova M., Miskufova a, Kukurugya F., and Takacova Z., "Leaching of copper and tin from used printed circuit boards after thermal treatment.", *Journal of hazardous materials*, **183**(2010)866–73.

[146] Guan J., Wang J., Min X., and Wu W., "The Products Characteristics of Calcium-basic

Compounds Pyrolysis with Waste Printed Circuit Boards (PCB)", *Procedia Environmental Sciences*, **16**(2012)461–468.

[147] Zhou G., Luo Z., and Zhai X., "Experimental Study on Metal Recycling from Waste PCB", (2007)155–162.

[148] Veldhuizen H. and Sippel B., "Mining discarded electronics", *Industry and environment*, **17**(1994)7–11.

[149] Leirnes J.S. and Lundstrom M.S., Google Patents US4415360, 1983

[150] Hagelüken C., "Recycling of electronic scrap at Umicore  $\hat{a} \in \mathbb{T}^{M}$  s integrated metals smelter and refinery", 1–16.

[151] Achtilých U.Š.Ľ. and Umicore K., "Recycling of electronic scrap at umicore precious metals", *Acta Metallurgica Slovaca*, (2006)111–120.

[152] Taylor, P.R., Pirzada, S. A., "Thermal Plasma Processing of Materials: A Review", *Advanced Performance Materials*,(1) 1(1994)35–50.

[153] El-Kaddah N., "Thermal plasma applications in materials and metallurgical processing", International symposium sponsored by TMS Process Fundamentals Committee, The Minerals, Metals & Materials Society, USA 1992.

[154] Rath S.S., Nayak P., Mukherjee P.S., Chaudhury G.R., and Mishra B.K., "Treatment of electronic waste to recover metal values using thermal plasma coupled with acid leaching – A response surface modeling approach", *Waste Management*, **32**(2012)575–583.

[155] Quan C., Li A., and Gao N., "Combustion and Pyrolysis of Electronic Waste: Thermogravimetric Analysis and Kinetic Model", *Procedia Environmental Sciences*, **18**(2013)776–782.

[156] Flandinet L., Tedjar F., Ghetta V., and Fouletier J., "Metals recovering from waste printed circuit boards (WPCBs) using molten salts", *Journal of Hazardous Materials*, **213**–**214**(2012)485–490.

[157] Jha M.K., Lee J.C., Kumari A., Choubey P.K., Kumar V., and Jeong J., "Pressure leaching of metals from waste printed circuit boards using sulfuric acid", *Jom*, **63**(2011)29–32.

[158] Veit H.M., Bernardes A.M., Ferreira J.Z., Tenório J.A.S., and de Fraga Malfatti C., "Recovery of copper from printed circuit boards scraps by mechanical processing and electrometallurgy.", *Journal of hazardous materials*, **137**(2006)1704–9.

[159] Ping Z., ZeYun F., Jie L., Qiang L., Guangren Q., and Ming Z., "Enhancement of leaching copper by electro-oxidation from metal powders of waste printed circuit board.", *Journal of hazardous materials*, **166**(2009)746–750.

[160] Kim E.Y., Kim M.S., Lee J.C., Jeong J., and Pandey B.D., "Leaching kinetics of copper from waste printed circuit boards by electro-generated chlorine in HCl solution", *Hydrometallurgy*, **107**(2011)124–132.

[161] Behnamfard A., Salarirad M.M., and Veglio F., "Process development for recovery of copper and precious metals from waste printed circuit boards with emphasize on palladium and gold leaching and precipitation.", *Waste management*, **33**(2013)2354–63.

[162] Vegliò F., Quaresima R., Fornari P., and Ubaldini S., "Recovery of valuable metals from

electronic and galvanic industrial wastes by leaching and electrowinning", *Waste Management*, **23**(2003)245–252.

[163] Yang H., Liu J., and Yang J., "Leaching copper from shredded particles of waste printed circuit boards", *Journal of Hazardous Materials*, **187**(2011)393–400.

[164] Rudnik E., Pierzynka M., and Handzlik P., "Ammoniacal leaching and recovery of copper from alloyed low-grade e-waste", *Journal of Material Cycles and Waste Management*, **18**(2014)318–328.

[165] Montero R., Guevara A., and De La Torre E., "Recovery of gold, silver, copper and niobium from printed circuit boards using leaching column technique", *Journal of Earth Science and Engineering*, **2**(2012)590–595.

[166] Mecucci A. and Scott K., "Leaching and electrochemical recovery of copper, lead and tin from scrap printed circuit boards",(4)77(2002)449–457.

[167] Jha M.K., Kumari A., Choubey P.K., Lee J.C., Kumar V., and Jeong J., "Leaching of lead from solder material of waste printed circuit boards (PCBs)", *Hydrometallurgy*, **121**–**124**(2012)28–34.

[168] Barakat M. a., "Recovery of metal values from zinc solder dross", *Waste Management*, **19**(1999)503–507.

[169] Kumari A., Jha M.K., Kumar V., et al., "Recovery of Lead From the Solder of waste printed circuit boards", R. Singh, A. Das, P.K. Banerjee, K.K. Bhattacharyya and N.G. Goswami (eds.), XI International Seminar on Mineral Processing Technology (MPT-2010, pp.891–897.

[170] Havlik T., Orac D., Berwanger M., and Maul A., "The effect of mechanical-physical pretreatment on hydrometallurgical extraction of copper and tin in residue from printed circuit boards from used consumer equipment", *Minerals Engineering*, **65**(2014)163–171.

[171] Townsend T., Musson S., Dubey B., and Pearson B., "Leachability of printed wire boards containing leaded and lead-free solder", *Journal of Environmental Management*, **88**(2008)926–931.

[172] Park Y.J. and Fray D.J., "Recovery of high purity precious metals from printed circuit boards.", *Journal of hazardous materials*, **164**(2009)1152–8.

[173] Petter P.M.H., Veit H.M., and Bernardes A.M., "Evaluation of gold and silver leaching from printed circuit board of cellphones", *Waste Management*, **34**(2014)475–482.

[174] Jing-ying L., Xiu-li X., and Wen-quan L., "Thiourea leaching gold and silver from the printed circuit boards of waste mobile phones.", *Waste management*, **32**(2012)1209–12.

[175] Ficeriová J., Baláž P., and Gock E., "Leaching of gold, silver and accompanying metals from circuit boards (PCBs) waste", *Acta Montanistica Slovaca*, **16**(2011)128–131.

[176] Tripathi A., Kumar M., Sau D.C., Agrawal A., Chakravarty S., and Mankhand T.R., Leaching of Gold from the Waste Mobile Phone Printed Circuit Boards (PCBs) with Ammonium Thiosulphate, *International Journal of Metallurgical Engineering 1*, 2012, 17–21.

[177] Birloaga I., De Michelis I., Ferella F., Buzatu M., and Vegliò F., "Study on the influence of various factors in the hydrometallurgical processing of waste printed circuit boards for

copper and gold recovery.", Waste management, 33(2013)935-941.

[178] Zheng S., Wang Y. y., and Chai L. yuan., "Research status and prospect of gold leaching in alkaline thiourea solution", *Minerals Engineering*, **19**(2006)1301–1306.

[179] Ha V.H., Lee J., Jeong J., Hai H.T., and Jha M.K., "Thiosulfate leaching of gold from waste mobile phones.", *Journal of hazardous materials*, **178**(2010)1115–9.

[180] Kasaini H., Kasongo K., Naude N., and Katabua J., "Enhanced leachability of gold and silver in cyanide media: Effect of alkaline pre-treatment of jarosite minerals", *Minerals Engineering*, **21**(2008)1075–1082.

[181] Xiu F.R., Qi Y., and Zhang F.S., "Leaching of Au, Ag, and Pd from waste printed circuit boards of mobile phone by iodide lixiviant after supercritical water pre-treatment", *Waste Management*, **41**(2015)134–141.

[182] Kinoshita T., Akita S., Kobayashi N., Nii S., Kawaizumi F., and Takahashi K., "Metal recovery from non-mounted printed wiring boards via hydrometallurgical processing", *Hydrometallurgy*, **69**(2003)73–79.

[183] Khaliq A., Rhamdhani M.A., Brooks G., and Masood S., "Metal Extraction Processes for Electronic Waste and Existing Industrial Routes: A Review and Australian Perspective", *Resources*,(1)3(2014)152–179.

[184] Lee J.C., Yoo J.M., Jeong J.K., and Jha M.K., US patent: US7867317B2, 2011.

[185] Vijayaram R., Nesakumar D., and Chandramohan K., "Copper extraction from the discarded printed circuit boards by leaching", *Research Journal of Engineering Sciences*, 2(2013)11–14.

[186] Kim E. young, Kim M. seuk, Lee J. chun, Yoo K., and Jeong J., "Leaching behavior of copper using electro-generated chlorine in hydrochloric acid solution", *Hydrometallurgy*, **100**(2010)95–102.

[187] Havlik T., Orac D., Petranikova M., and Miskufova a., "Hydrometallurgical treatment of used printed circuit boards after thermal treatment", *Waste Management*, **31**(2011)1542–1546.

[188] Koyama K., Tanaka M., and Lee J., "Copper Leaching Behavior from Waste Printed Circuit Board in Ammoniacal Alkaline Solution", *Materials Transactions*, **47**(2006)1788–1792.

[189] Oishi T., Koyama K., Alam S., Tanaka M., and Lee J.-C., "Recovery of high purity copper cathode from printed circuit boards using ammoniacal sulfate or chloride solutions", *Hydrometallurgy*, **89**(2007)82–88.

[190] Huang J., Chen M., Chen H., Chen S., and Sun Q., "Leaching behavior of copper from waste printed circuit boards with Br??nsted acidic ionic liquid", *Waste Management*, **34**(2014)483–488.

[191] Sheng P.P. and Etsell T.H., "Recovery of gold from computer circuit board scrap using aqua regia", *Waste Management & Research*, **25**(2007)380–383.

[192] Quinet P., Proost J., and Van Lierde A., Recovery of precious metals from electronic scrap by hydrometallurgical processing routes, *Minerals and Metallurgical Processing*,(1)**22**, (2005)17-22.

[193] Xiu-li X. and Jing-ying L., " Experimental study of thiourea leaching gold and silver from

waste circuit boards", Journal of Qingdao University(Engineering & Technology Edition), 26(2011)69–73.

[194] Jun W., Li-juan Q., Liang C., and Dong-hui C., "Gold and silver selectively leaching from printed circuit boards scrap with acid thiourea solution", *Nonferrous Metals*, **61**(2009)90–93.

[195] Brooy S.R.L., Linge H.G., and Walker G.S., "Review of gold extraction from ores", *Minerals Engineering*, 7(1994)1213–1241.

[196] Heath J.A., Jeffrey M.I., Zhang H.G., and Rumball J.A., "Anaerobic thiosulfate leaching: Development of in situ gold leaching systems", *Minerals Engineering*, **21**(2008)424–433.

[197] Yen W. and Xia C., "Effects of copper minerals on ammionical thiosulfate leaching of gold.", *Proceeding of XXIV International Mineral Processing Congress*, Science Press (2008).

[198] XU Q., CHEN D., CHEN L., and HUANG M., "Gold Leaching from Waste Printed Circuit Board by Iodine Process", *Nonferrous Metals*, **62**(2010)88–90.

[199] Castro L.A. and Martins A.H., "Recovery of tin and copper by recycling of printed circuit boards from obsolete computers", *Brazilian Journal of Chemical Engineering*, **26**(2009)649–657.

[200] Xiu F.-R. and Zhang F.-S., "Recovery of copper and lead from waste printed circuit boards by supercritical water oxidation combined with electrokinetic process.", *Journal of hazardous materials*, **165**(2009)1002–7.

[201] Kim E. young, Kim M. seuk, Lee J. chun, Jha M.K., Yoo K., and Jeong J., "Effect of cuprous ions on Cu leaching in the recycling of waste PCBs, using electro-generated chlorine in hydrochloric acid solution", *Minerals Engineering*, **21**(2008)121–128.

[202] Zhu P., Chen Y., Wang L.Y., Qian G.Y., Zhou M., and Zhou J., "A new technology for separation and recovery of materials from waste printed circuit boards by dissolving bromine epoxy resins using ionic liquid", *Journal of Hazardous Materials*, **239–240**(2012)270–278.

[203] Zhu P., Chen Y., Wang L.Y., Zhou M., and Zhou J., "The separation of waste printed circuit board by dissolving bromine epoxy resin using organic solvent", *Waste Management*, **33**(2013)484–488.

[204] Xiu F.-R. and Zhang F.-S., "Materials recovery from waste printed circuit boards by supercritical methanol.", *Journal of hazardous materials*, **178**(2010)628–34.

[205] Xiu F.-R., Qi Y., and Zhang F.-S., "Recovery of metals from waste printed circuit boards by supercritical water pre-treatment combined with acid leaching process.", *Waste management*, **33**(2013)1251–7.

[206] Zhu P., Chen Y., Wang L.Y., and Zhou M., "Treatment of waste printed circuit board by green solvent using ionic liquid", *Waste Management*, **32**(2012)1914–1918.

[207] Wath S.B., Katariya M.N., Singh S.K., Kanade G.S., and Vaidya A.N., "Separation of WPCBs by dissolution of brominated epoxy resins using DMSO and NMP: A comparative study", *Chemical Engineering Journal*, **280**(2015)391–398.

[208] Chien Y.-C., Wang H.P., Lin K.-S., and Yang Y., "Oxidation of printed circuit board wastes in supercritical water", *Water Research*, **34**(2000)4279–4283.

[209] Zhu P., Chen Y., Wang L.Y., Qian G.R., Zhou M., and Zhou J., "A novel approach to

separation of waste printed circuit boards using dimethyl sulfoxide", *International Journal of Environmental Science and Technology*, **10**(2013)175–180.

[210] Haugan E. and Dalsjo P., "Characterization of the material properties of two FR4 printed circuit board laminates", Report: Norwegian Defence Research Establishment (FFI), Kjeller, Norway, 2014, pp. 1-40.

[211] Zhu P., Chen Y., Wang L., et al., "Dissolution of brominated epoxy resins by dimethyl sulfoxide to separate waste printed circuit boards", *Environmental Science and Technology*, **47**(2013)2654–2660.

[212] The Merck Index-DMSO, *Royal Society of Chemistry*, 2013. https://www.rsc.org/Merck-Index/monograph/m4555/dimethyl sulfoxide?q=authorize.

[213] The MERCK Index - NMP, *Royal Society of Chemistry*, 2016. https://www.rsc.org/MerckIndex/monograph/print/m7460/methylpyrrolidone?q=authorize.

[214] EPA-C., "Chemicals known to the state to cause cancer or reproductive toxicity," Report: Environmental Protection Agency, State of California; Safe Drinking Water and Toxic Enforcement Act of 1986, 2015, pp. 1–23.

[215] Lankford J.I. and Criss C.M., "Partial molar heat capacities of selected electrolytes and benzene in methanol and dimethylsulfoxide at 25, 40, and 80°C", *Journal of Solution Chemistry*, **16**(1987)885–906.

[216] Marchidan D.I. and Ciopec M., "Relative Enthalpies and related thermodynamic functions of some organic compounds by drop calorimetry", *Journal of Thermal Analysis*, **14**(1978)131–150.

[217] Marsella J.A., DIMETHYLFORMAMIDE, Kirk-Othmer Encyclopedia of Chemical Technology. John Wiley & Sons, USA, 2013.

[218] Kolman A., Dimethylformamide, Report: ACuteTox- Research Project for Alternative Testing, University of Oulu, Linnanmaa, Finland, 2007, 1–6.

[219] Long G., Meek M.E., and Lewis M., "Concise International Chemical Assessment Document 31, N,N-Dimethylformamide", Report: World Health Organization, Geneva, 2001 pp. 1-56.

[220] Watts J.C. and Larson P.A., Dimethylacetamide, Kirk-Othmer Encyclopedia of Chemical Technology, John Wiley & Sons, Inc., USA, 2002,1–6.

[221] PubChem., N,n-dimethylacetamide, *Open Chemistry database*, Report: National Center for Biotechnology Information, U.S. National Library of Medicine, USA, 2016, pp. 1–62.

[222] Luda M.P., Balabanovich A.I., Zanetti M., and Guaratto D., "Thermal decomposition of fire retardant brominated epoxy resins cured with different nitrogen containing hardeners", *Polymer Degradation and Stability*, **92**(2007)1088–1100.

[223] Nikolic G., Zlatkovic S., Cakic M., Cakic S., Lacnjevac C., and Rajic Z., "Fast fourier transform IR characterization of epoxy GY systems crosslinked with aliphatic and cycloaliphatic EH polyamine adducts", *Sensors*, **10**(2010)684–696.

[224] Kang Y., Zhou L., Li X., and Yuan J., "β-Cyclodextrin-modified hybrid magnetic nanoparticles for catalysis and adsorption", *Journal of Materials Chemistry*, **21**(2011)3704–

3710.

[225] Morse G.E., Paton A.S., Lough A., and Bender T.P., "Chloro boron subphthalocyanine and its derivatives: dyes, pigments or somewhere in between?", *Dalton transactions (Cambridge, England : 2003)*, **39**(2010)3915–3922.

[226] ASTM D86 – 16a., Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure, Technical Report: ASTM International, USA, 2016, pp. 1–28.

[227] Ferris A.M. and Rothamer D.A., "Methodology for the experimental measurement of vapor – liquid equilibrium distillation curves using a modified ASTM D86 setup", *Fuel*, **182**(2016)467–479.

[228] Basha S.M., "Effect of pre-treatment by organic solvents on leaching of copper from waste printed circuit boards", M.Tech. Thesis, Indian Institute of Technology (Banaras Hindu Universisty)-Varanasi, India, 2017.

[229] "Introduction Dimethylformamide Cas N °: 68-12-2, Screening Information Dataset (SIDS)", Report: United Nations Protection Agency, 2003.

[230] Silverstein R.M. and Webster F.X., Spectrometric Identification of Organic Compounds, Wiley India, 2013.

[231] Gottlieb H.E., Kotlyar V., and Nudelman A., "NMR chemical shift of common laboratory solvents as trace impurities", *Journal of Organic Chemistry*, **62**(1997)7512–7515.

[232] Singho N.D., Lah N.A.C., Johan M.R., and Ahmad R., "FTIR studies on silver-poly(methylmethacrylate) nanocomposites via in-situ polymerization technique", *International Journal of Electrochemical Science*, 7(2012)5596–5603.

[233] Nikje M.M.A. and Askarzadeh M., "Green and inexpensive method to recover Bisphenol-A from polycarbonate wastes", *Polímeros*, **23**(2013)29–31.

[234] González-González M., Cabanelas J.C., and Baselga J., Infrared Spectroscopy – Materials Science, Engineering and Technology. InTech publication, 2012.

[235] Huang Z., Yu L., Dai Y., and Wang H., "Hydrogen bonding interactions between N, N-dimethylformamide and cysteine: DFT studies of structures, properties, and topologies", *Structural Chemistry*, **22**(2011)57–65.

[236] Mushtaq A., Mukhtar H. Bin, and Shariff A.M., "FTIR study of enhanced polymeric blend membrane with amines", *Research Journal of Applied Sciences, Engineering and Technology*, 7(2014)1811–1820.

[237] Verbovy D.M., Smagala T.G., Brynda M.A., and Fawcett W.R., "A FTIR study of ionsolvent interactions in N,N-dimethylacetamide", *Journal of Molecular Liquids*, **129**(2006)13– 17.

[238] Kim J., Gracz H.S., Roberts G.W., and Kiserow D.J., "Spectroscopic analysis of poly ( bisphenol A carbonate ) using high resolution 13 C and 1 H NMR", *polymers*, **49**(2008)394–404.