

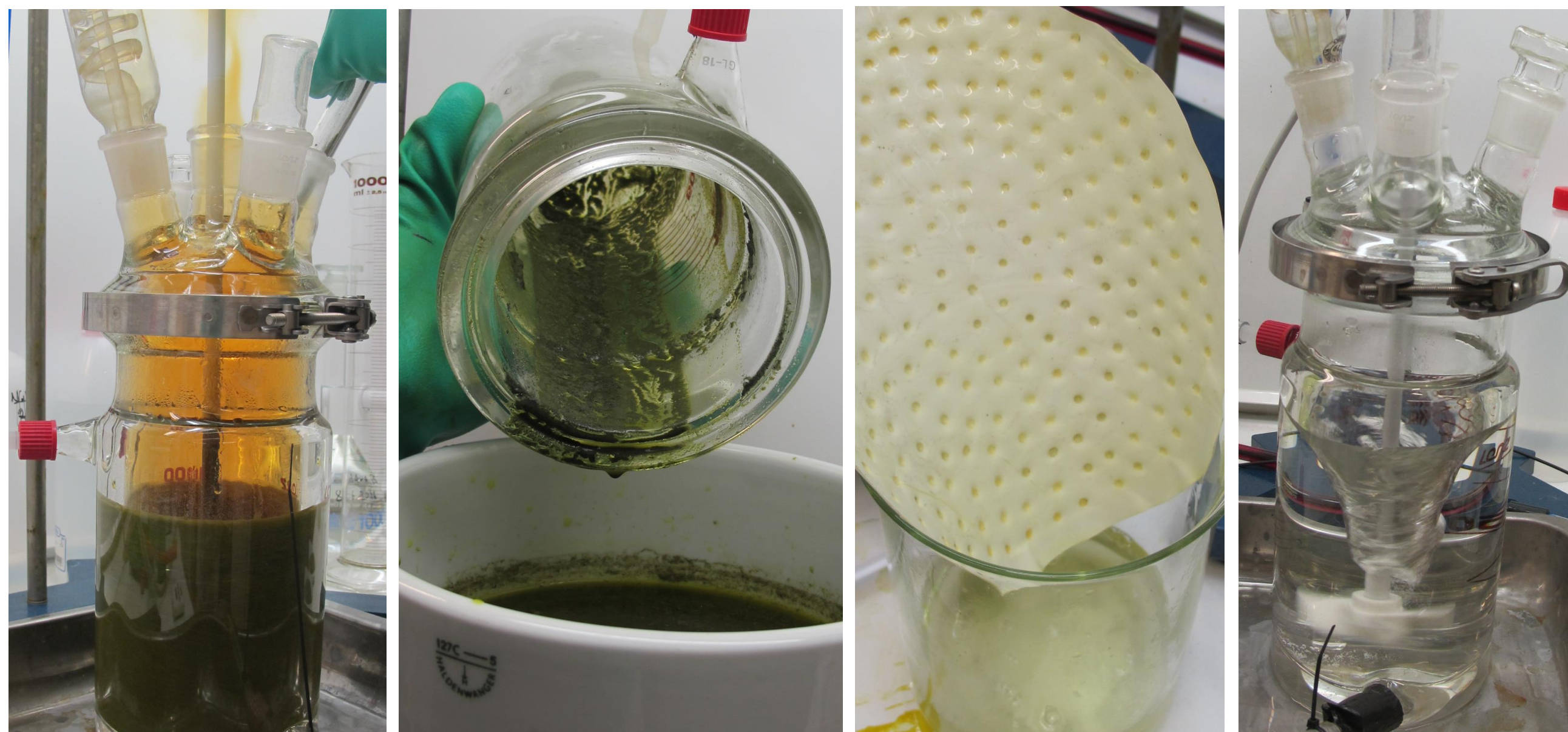


Gold mass balance in PCB dust leaching

Pirkka Ollonqvist, VTT Technical Research Centre of Finland Ltd

Background

Gold, among other noble metals, accounts for over 80% of printed circuit board (PCB) value.¹ The pretreatment process of PCB generates dust and according to certain studies gold has an enrichment tendency to the dust fraction.² The hydrometallurgical method of gold recovery is a one approach to utilize the dust fraction. In this thesis the factors affecting the mass balance of gold in leaching were studied.



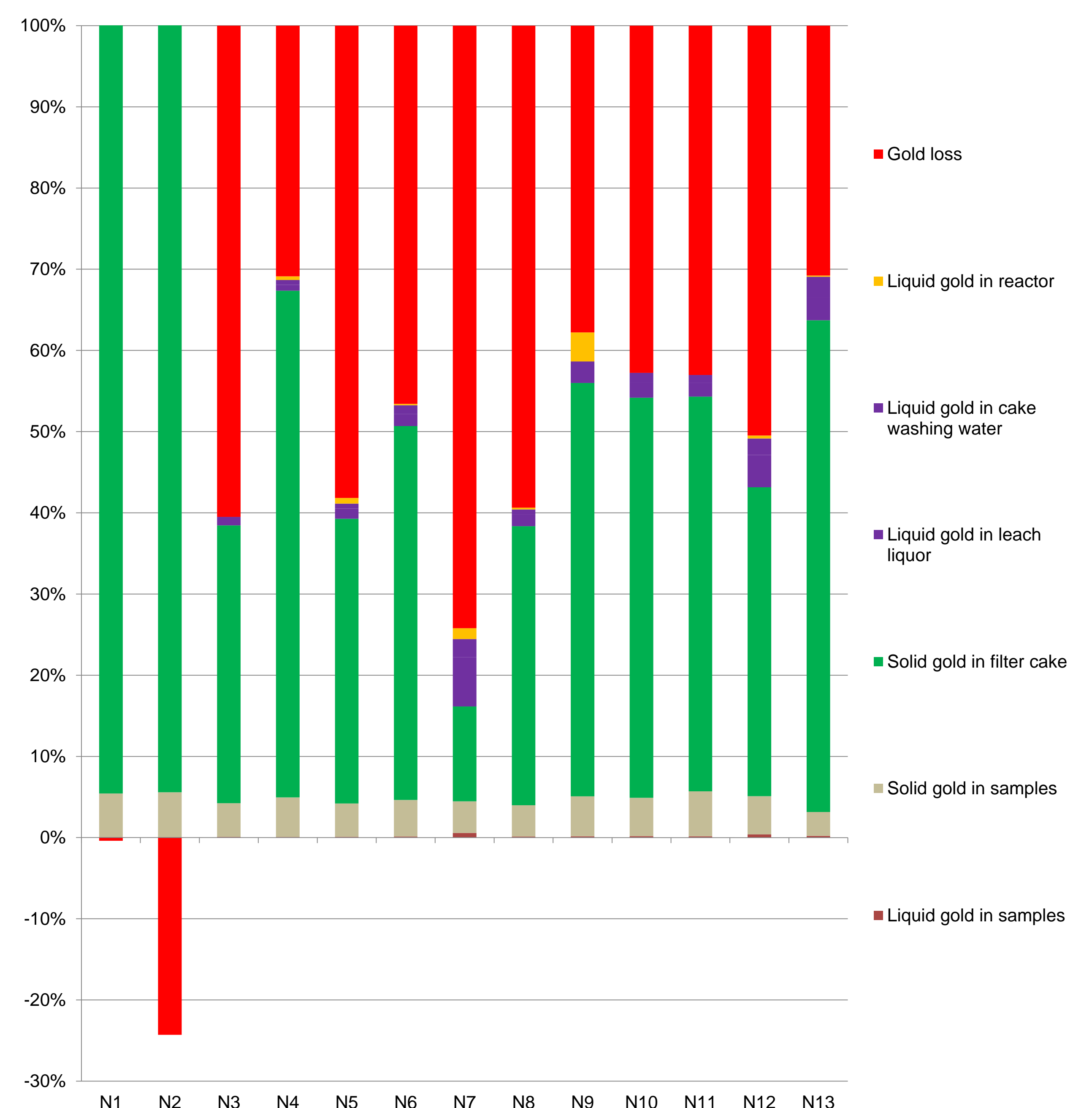
Materials and methods

The dust sample was provided by Kuusakoski Oy from their pretreatment process, which was used in the leaching experiments both untreated and pretreated with flotation and nitric acid leaching. Leaching experiments were conducted as batch leaching in leaching reactors using aqua regia that is a mixture of HCl and HNO₃. There were three variables in the experiments: gold content in the system, temperature and acid concentration. In the experiments the gold concentration was measured from leach liquor, filter cake, cake washing water and leach liquor from empty reactor leaching experiments.

Exp.	Material	Au content in the system (ppm)	T (°C)	Acid conc. (%)
N1	Untreated dust	10	25	32
N2	Untreated dust	30	25	32
N3	Untreated dust	10	75	32
N4	Untreated dust	30	75	32
N5	Untreated dust	10	25	48
N6	Untreated dust	30	25	48
N7	Untreated dust	10	75	48
N8	Untreated dust	30	75	48
N9	Untreated dust	20	50	40
N10	Untreated dust	20	50	40
N11	Untreated dust	20	50	40
N12	Pretreated with HNO ₃ leaching	20	50	40
N13	Pretreated with flotation	20	50	40

Results

The factors affecting the mass balance of gold revealed that the gold loss was substantial in most of the experiments.



Conclusion

The uncertainty factors in gold content measurement were identified as a key factor in high gold loss. The gold amount in leach liquor was low in all of the experiments. Two key factors were identified: “Preg-robbing” - phenomena caused by high organic carbon content and dissolution of competing base metals. The relatively high gold content in cake washing water (in comparison to leach liquor) was explained by the cellulose-acetate (filter material) ability to adsorb gold and the amount of gold remained in the reactor was explained by the gold tendency to precipitate on glass surface.

Sources

¹ Park, Y. J. & Fray, D. J. 2009. Recovery of high purity precious metals from printed circuit boards. *Journal of Hazardous Materials*. Vol. 164:2-3, pp. 1152-1158.
² Bachér, J., Mroczek, A. & Wahlström, M. 2015. Mechanical pre-treatment of mobile phones and its effect on the Printed Circuit Assemblies (PCAs). *Waste Management* Vol.45, 29 June, pp. 235-245.
 Guo, C., Wang, H., Liang, W., Fu, J., Yi, X. 2011. Liberation characteristic and physical separation of printed circuit board (PCB). *Waste Management*. Vol. 31:9-10, pp. 2161-2166

