

Article

Optimization, Kinetic Studies of Tin Leaching from Waste Printed Circuit Boards and Selective Tin Recovery from Its Pregnant Solution

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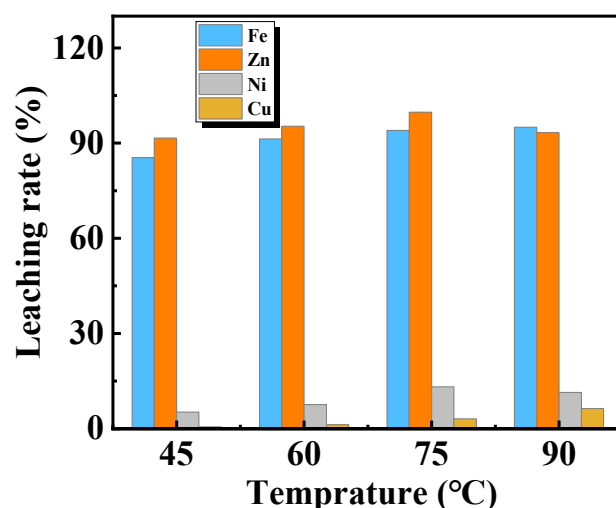


Figure S1. The effect of temperature on leaching rates of various metals.

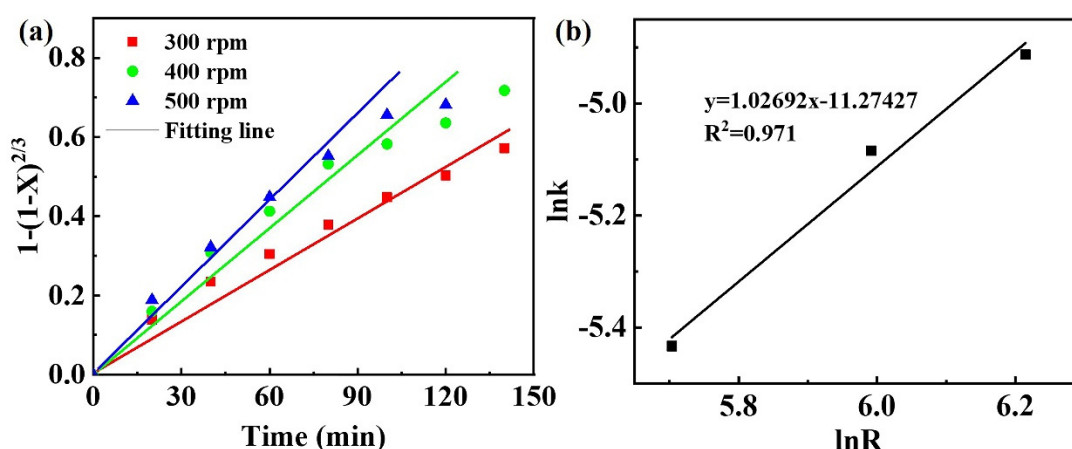


Figure S2. (a) Plot of $[1-(1-X)^{2/3}]-t$ for Sn at different stirring speed and (b) relationship between $\ln k$ and $\ln R$ for Sn.

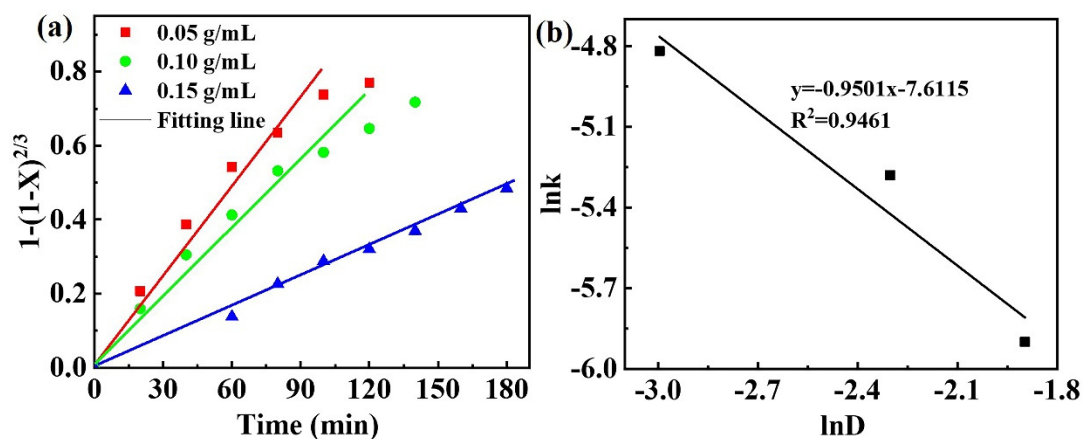


Figure S3. (a) Plot of $[1-(1-X)^{2/3}]-t$ for Sn at different solid-liquid ratio and (b) relationship between $\ln k$ and $\ln D$ for Sn.

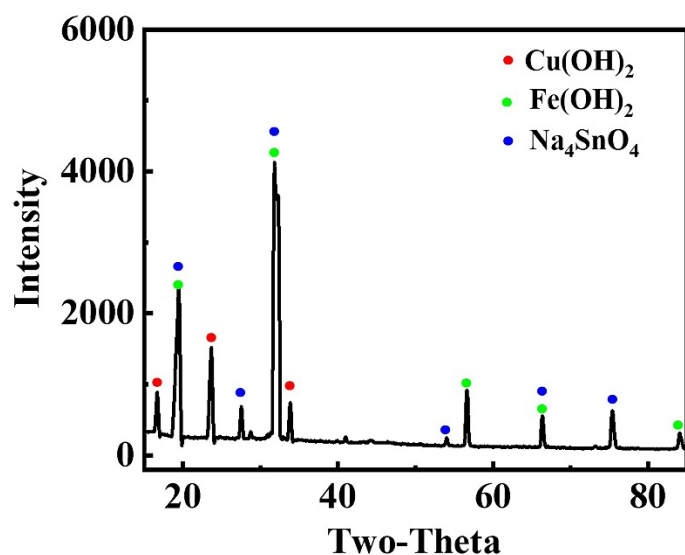


Figure S4. The XRD analysis of precipitation product obtained at pH=2.

Table S1. Fitting results of kinetic equations of Sn.

T/K	Chemical control reaction		Diffusion control reaction		Mixed control reaction		Surface control reaction	
	$1-(1-X)^{1/3}=k_1t$		$1-2/3X-(1-X)^{2/3}=k_2t$		$1-(1-X)^{2/3}=k_3t$		$1-(1-0.45X)^{1/3}=k_4t$	
	R^2	k	R^2	k	R^2	k	R^2	$k/10^3$
318	0.98658	0.00157	0.96235	-0.25794	0.98321	0.00291	0.98021	0.51324
333	0.98541	0.00218	0.92201	-0.26958	0.97314	0.00401	0.96041	0.55073
348	0.98034	0.0034	0.93479	-0.27989	0.99251	0.00594	0.95215	0.61214
363	0.97046	0.00452	0.85167	-0.25350	0.97167	0.00734	0.97037	0.95147

Table S2. The concentration of Sn in solution at different pH (mol/L).

pH	0.5	1	1.5	2	2.5	3	3.5	4	4.5
Cu	2.18×10^7	2.18×10^6	2.18×10^5	2.18×10^4	2.18×10^3	2.18×10^2	21.8	2.18	2.18×10^{-1}
Fe	7.94×10^{11}	7.94×10^{10}	7.94×10^9	7.94×10^8	7.94×10^7	7.94×10^6	7.94×10^5	7.94×10^4	7.94×10^3
Ni	1.99×10^{12}	1.99×10^{11}	1.99×10^{10}	1.99×10^9	1.99×10^8	1.99×10^7	1.99×10^6	1.99×10^5	1.99×10^4
Zn	1.20×10^{10}	1.20×10^9	1.20×10^8	1.20×10^7	1.20×10^6	1.20×10^5	1.20×10^4	1.20×10^3	1.20×10^2
Al	6.0×10^8	1.9×10^6	6.0×10^4	1.9×10^3	6.0×10^1	1.9	0.6×10^{-1}	1.9×10^{-3}	6.0×10^{-5}

Table S3. The content of the calcinating product.

Elements	Sn	Cu	Fe
Contents (wt%)	77.98	0.60	0.18