



- **Cite this as:** Pei-wang Zhu, Hua Dai, Lei Han, Xiu-lin Xu, Le-ming Cheng, Qin-hui Wang, Zheng-lun Shi, 2015. Aluminum extraction from coal ash by a two-step acid leaching method. Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering), 16(2):161-169. [doi:10.1631/jzus.A1400195]

Aluminum extraction from coal ash by a two-step acid leaching method

Key words: Coal ash; aluminum dissolution; acid leaching; roasting

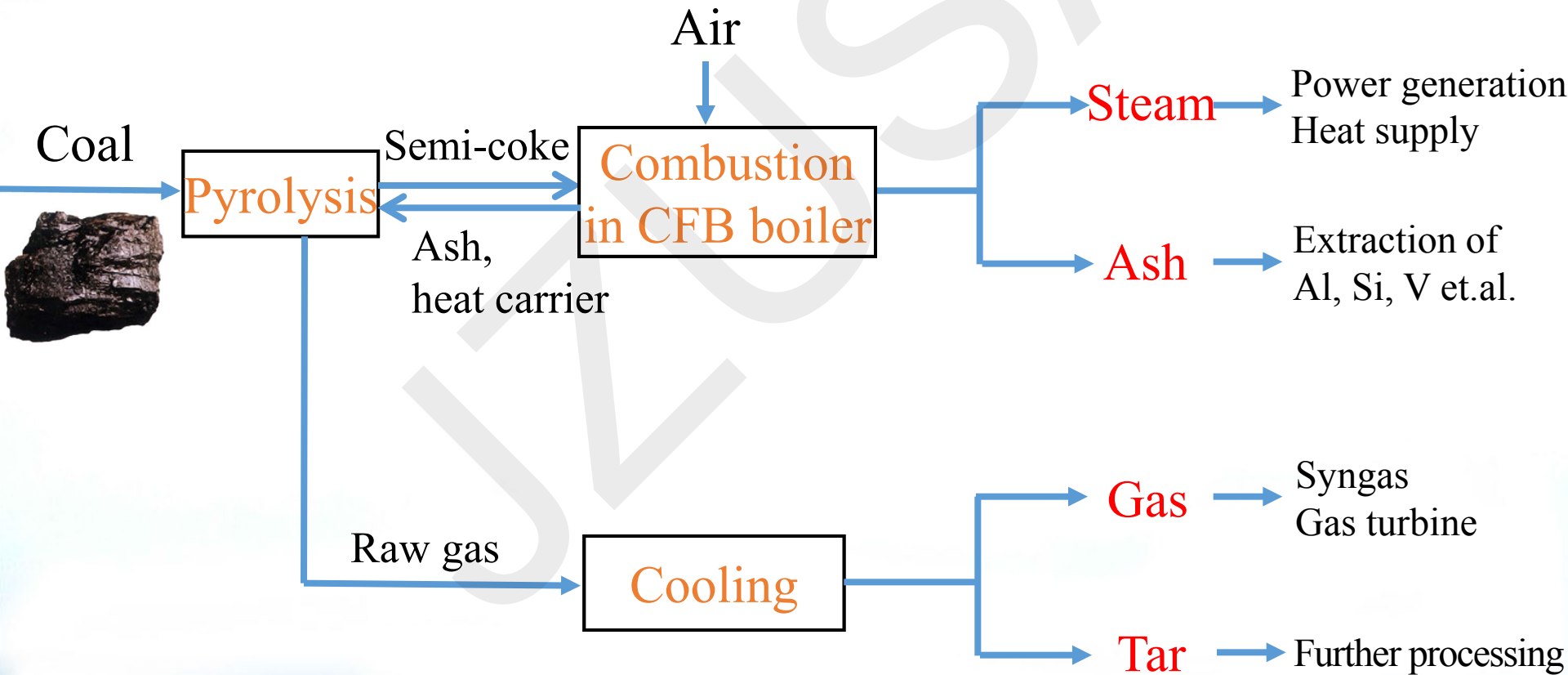




Introduction



- Grade utilization of coal (Coal provides both energy and resources)





Introduction



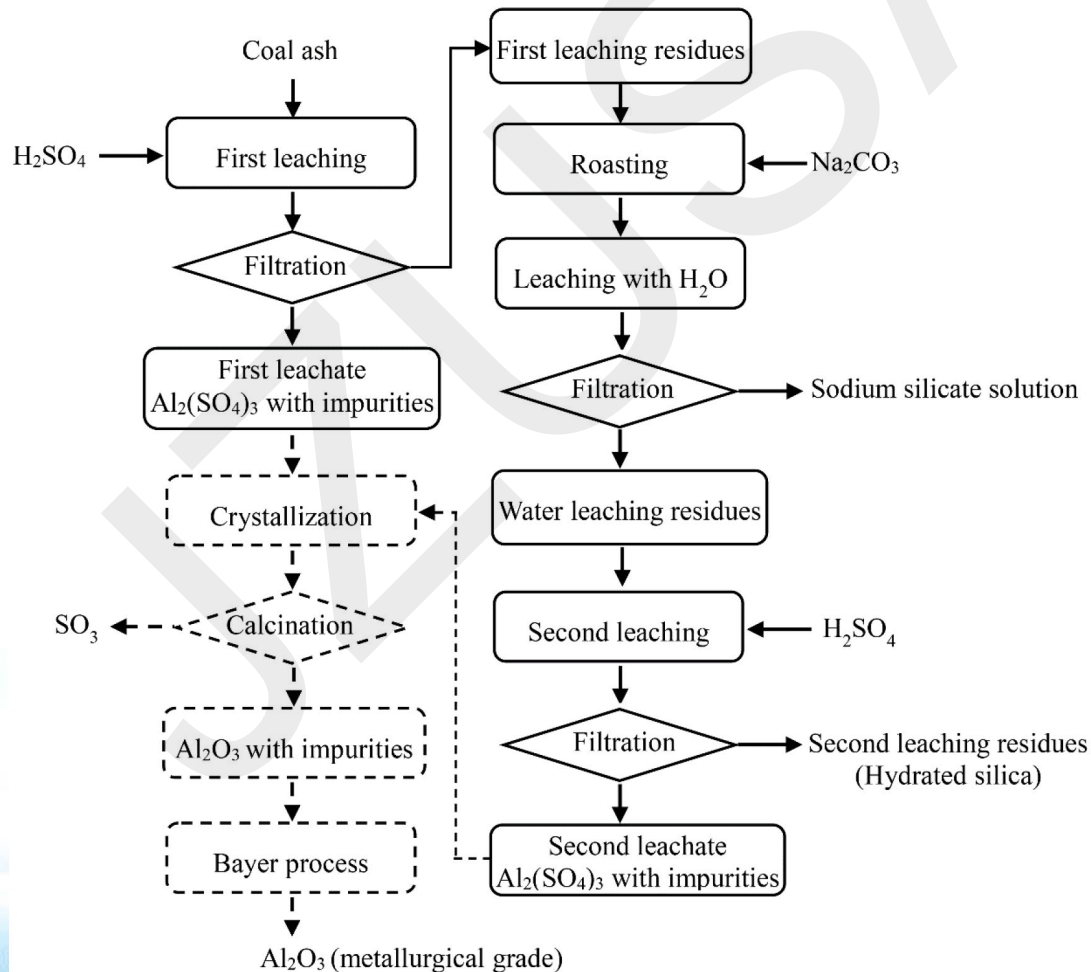
- Coal ash emissions were 532 million tons in China, 2013.
- The average Al_2O_3 content is 27.8wt% in China's coal ash.
- China's bauxite demand heavily reliant on imports. Aluminum dependence on foreign resources is 63%.
- Al_2O_3 extraction from coal ash is of great significance for both alumina industry and coal ash utilization.



Method

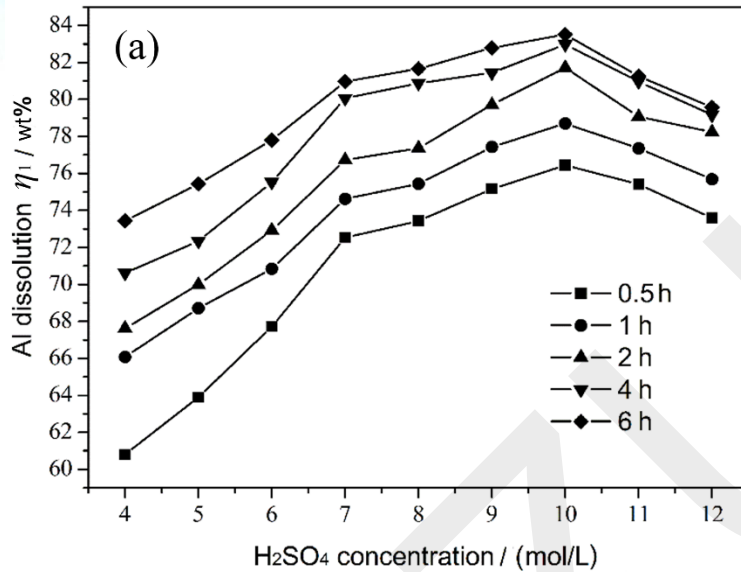


- The process flowchart of aluminum extraction with a two-step acid leaching method

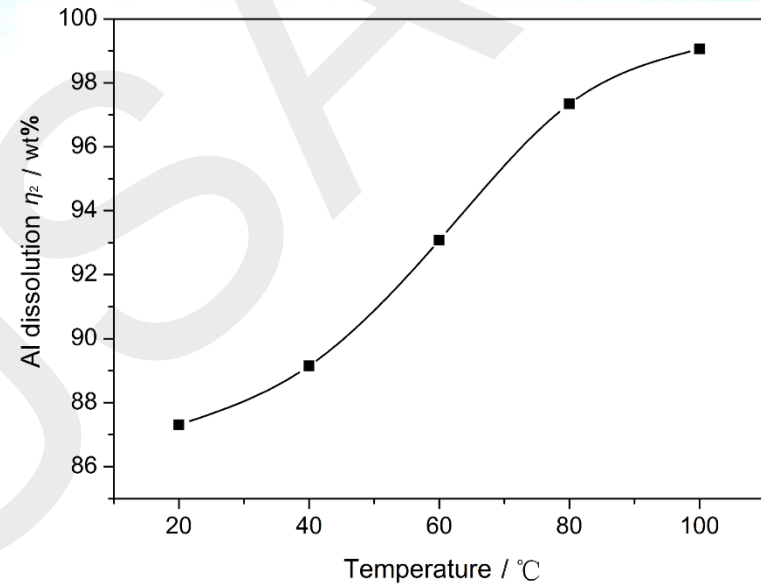




Results



● First leaching



● Second leaching

Table: Total aluminum dissolution through two-step leaching process

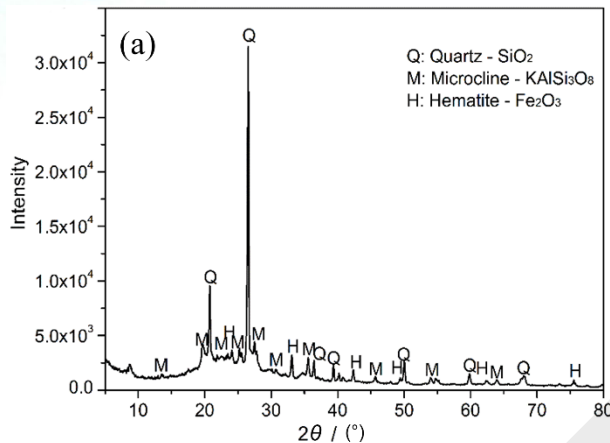
Temperature of second leaching	20°C	40°C	60°C	80°C	100°C
Total aluminum dissolution / %	97.68%	98.02%	98.74%	99.51%	99.83%



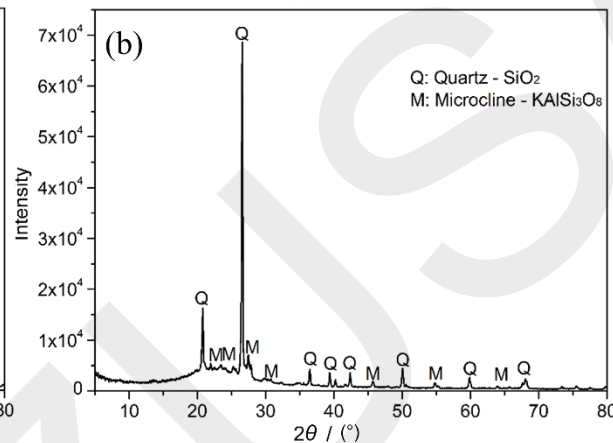
Results



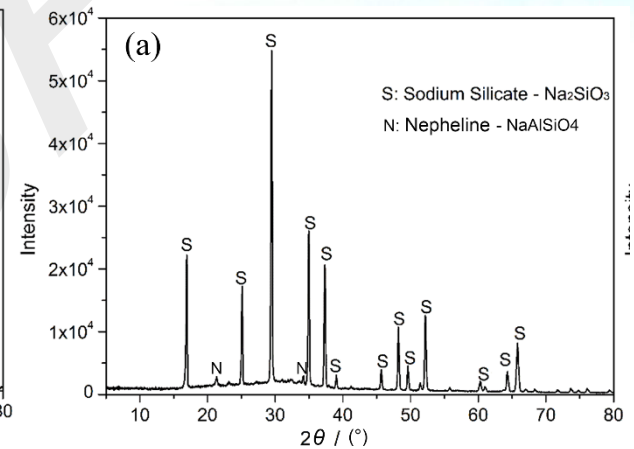
● XRD patterns



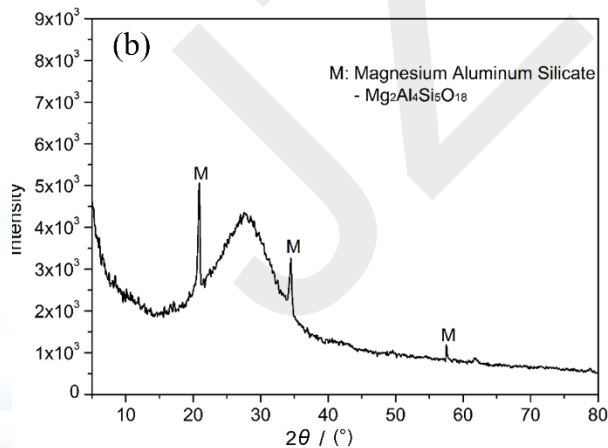
● Raw coal ash



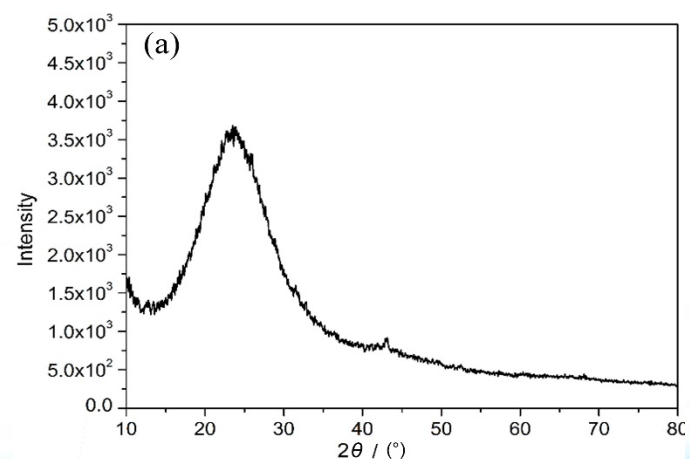
● First leaching residues



● Roasting product



● Water leaching residues



● Second leaching residues



Conclusion



- In the first leaching test with 10 mol/L sulfuric acid at 120°C in 2 h and an S/L of 1:2, aluminum dissolution (η_1) from raw coal ash reached 81.72%.
- In the second leaching with sulfuric acid, The aluminum dissolution (η_2) from the WLR reached 87.31% at 20°C and 99.06% at 100°C.
- The total aluminum dissolution (η) by the two-step leaching process was more than 97%, which was a significant improvement on the aluminum dissolution in the first leaching tests.