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Key Environmental Issue Webinar Series 12 for Overseas Chinese Environmental Engineers & Scientists Association

海外華人環境保護學會環境議題網上論壇(Twelveth)

Migration and Transformation of Harmful Trace Elements in the Process of Recovering Rare Earth Elements from Coal Fly Ash Activated by NaOH Roasting

April 16, 2023: 6:00-7:00 PM PDT (9:00-10:00PM EST) /

April 17, 2023: 9:00-10:00 AM 中国标准时间



[About the Speaker] Dr. Tao Wang is an associate professor in North China Electric Power University. He obtained the bachelor's degree and PhD degree from North China Electric Power University in 2010 and 2015, respectively. He was jointly trained at Princeton University from 2013 to 2014, mainly engaged in the research on resource utilization of solid waste, pollutant control in coal-fired flue gas. Principal investigator of the National Natural Science Foundation of China, China's National Key R&D Programmes, and more than 10 projects. He has published more than 90 academic papers, 2 chapters of a book and 8 national invention patents, and was awarded first prize of China Electricity Council innovation Award and second prize of State Electric Power Science and Technology Progress Awards.

[Abstract] This two-year project aims to study migration of Harmful Trace Elements (HTE) in the process of recovering Rare Earth Elements (REE) from coal fly ash. Firstly, the contents of REE in coal and coal gangue and their static combustion products in laboratory and dynamic combustion products in power plants were determined. the outlook coefficient of REE in coal and coal gangue and their combustion products are greater than 0.7, and the content of critical rare earth elements is more than 30%. The total REE content in fly ash of three power plants is higher than the world average, and it has great potential to recover rare earth elements. the REE mainly occurred as the acid-soluble and aluminosilicate fraction. At the same time, the content of REE in coal and coal gangue is positively correlated with ash content, and negatively correlated with volatile content. Then, REE in fly ash was extracted by NaOH roasting activation-water leaching-acid leaching. under the conditions of an alkali-to-ash ratio of 1.2:1 and roasting temperature 318°C, the glass phase in fly ash can be effectively decomposed, and the recovery rate of REE in fly ash can reach more than 90%. Finally, the migration of HTE were analyzed. mercury compounds, i.e., Hg_2Cl_2 , HgCl_2 , and HgSO_4 in fly ash were converted into HgO during NaOH roasting activation. At the same time, the generated water reduced part of HgO to elemental Hg during calcination, which increased the release of Hg in fly ash at low temperature; In addition, other harmful elements, such as As, Se, Pb, Cd, Cr, have also undergone a chemical transformation during NaOH roasting.

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