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Advancements in exploitation of critical metals from alternative resources

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EDITORIAL

Advancements in exploitation of critical metals from alternative resources

Aiming to a resource-efficient, low-carbon, and sustainable society, many elements and their compounds are critical raw materials (CRMs) for green and advanced technology (Ilyas et al., 2022; Moss et al., 2011). In addition, the quality of modern life depends on access to these critical metals, which are irreplaceable in new technological devices and equipment (Goodenough et al., 2018; Ilyas et al., 2021a, 2021b). The post-COVID-19 situation (Ilyas et al., 2022) and current geopolitical scenario after the opening of several new conflict zones worldwide (Geng et al., 2023), combined with the foreseen energy crisis, have presented an unpredicted global stress to the supply chain of critical metals. They are of great interest in renewable energy deployments, albeit currently at a higher risk of disrupted supply and uneven distribution of their primary production, coupled with a fast depletion of mineral resources (Paulick & Machacek, 2017; Pell et al., 2021).

Together, the aforementioned scenarios are certainly not good for the sustainable growth of modern society (The 17 Goals-UNSDG, 2015). Therefore, extensive research on the development of new methods and engineering processes for critical metals' extraction from various resources has become the need of the hour. In particular, the search for new alternatives other than the primary ores is being sought to mitigate the supply risks of these metals/CRMs. Given that the attention paid to efficient exploitation of low-grade ores, mine tailings, municipal and industrial wastes, end-of-life materials, and urban mine stockpiles can present potential alternatives to draw a circular economy pathway for the resource recycling of critical metals (Ilyas et al., 2021).

Accordingly, this special issue focused on '*Advancements in exploitation of critical metals from alternative resources*' was commissioned to provide a common platform for the known researchers actively contributing in the area of recycling and the circular economy of critical metals, or CRMs. This special issue contains seven articles from authors of six countries, including India, South Africa, Vietnam, South Korea, Pakistan, and Nepal.

The special issue actively discusses topics related to rare earths' extraction from spent fluorescent lamps, solvent extraction of gold from waste PCB leached solution, Ni-Cd recovery from used batteries, zinc and lead recycling from incinerated municipal solid waste, cathode metals recovery from spent LCMO batteries, the role of coal particle size distribution in metals' extraction from the coal itself, and a review on mineral acids recycling from industrial waste streams using solvent extraction.

We hope that the articles published in this special issue will fill the knowledge gaps in the subject area and be of great help to the readers of *Geosystem Engineering*.

Disclosure statement

No potential conflict of interest was reported by the authors.

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