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Special Issue Reprint

Toward Achieving a Carbon-Neutral Society

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This Special Issue presents recent advances in beneficiation and extractive metallurgical technologies aimed at enabling a carbon-neutral and circular supply of critical metals. It brings together nine contributions addressing the recovery of key materials—including Li, Au, Cu, Ni, Co, and rare-earth elements—from both primary ores and secondary resources such as slags, industrial wastes, and biomass. The collected studies cover a wide range of physical, hydrometallurgical, pyrometallurgical, and bio-based processes, highlighting environmentally benign and low-energy approaches. Several contributions focus on alternative lixiviants, selective recovery strategies, and process intensification techniques to improve metal recovery efficiency and reduce environmental impact. Others explore the valorization of non-traditional resources and provide fundamental insights into metal behavior relevant to sustainable extraction. Together, these papers offer a comprehensive overview of current challenges, technological progress, and future directions in sustainable metallurgy for critical metal production.

