Innovation in Electrochemical Technology: from Batteries to Metals Extraction

電気化学テクノロジーにおけるイノベーション：電池から金属抽出まで

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The road to sustainability is paved with electrochemical technology. Whether it be the problem of intermittency in the generation of electricity by renewable sources such as wind or solar or the problem of the carbon intensity associated with metals production, e.g., iron making in the blast furnace and aluminium smelting in the Hall-Héroult cell, electrochemical technologies can enable radical innovation in concert with sustainable development. Examples of applied electrochemistry in action will be illustrated in two different settings: (1) metals production by molten oxide electrolysis (MOE), which is the electrolytic decomposition of a metal oxide into molten metal and oxygen gas. MOE represents an environmentally sound alternative to today's carbon-intensive thermochemical metals reduction processes and can be used not only for primary metals production but also remediation of hazardous waste; (2) stationary batteries for storage and delivery of off-peak power. Here the emphasis is on colossal current capability, e.g., 100s of kA with a footprint measuring 10s of metres, long service lifetime, and very low cost. Such large format batteries are the key enabling technology for carbon-free renewable, but intermittent, electric power generation.

電気化学テクノロジーは、持続可能な発展、開発を導く技術革新（イノベーション）を実現できる。再生可能エネルギー（風力、太陽光）が本質的に有する出力変動性、炭素に大きく依存する現在の金属製造プロセスーこうした課題に対する電気化学の応用について、現在進行中である２つの研究を報告する。
(1) 溶融酸化物の電気分解による金属製錬：炭素を利用した（二酸化炭素を排出する）金属還元プロセスに代わる、環境に優しい方法。有害廃棄物の浄化にも応用可能。
(2) オフピーク電力の貯蔵と供給に利用する定置型電池：大電流、長寿命、低コストが特長。炭素フリーの再生可能エネルギーによる発電に役立つテクノロジー。