Supporting Information to

Rare-Earth Quantum Cutting in Metal Halide Perovskites – a Review

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S1 Quantifying how *rare* Yb is for PV applications

Derivation of how much surface area could be covered by Yb-based QC PV technology basing on the amount of Yb currently present in the upper 3 km Earth's crust.

- Mass of Yb in the upper 3 km of the Earth's crust

  Radius of the Earth, $r_{Earth} = 6.35 \cdot 10^3$ km

  Volume of a spherical shell corresponding to the upper 3 km of the Earth's crust,
  $V_{crust} = \frac{4}{3}\pi\, r_{Earth}^3 - \frac{4}{3}\pi\,(r_{Earth} - 3\text{ km})^3$
  $= 1.59 \cdot 10^9$ km^3 $(= 1.59 \cdot 10^{24}$ cm$^3)$

  Abundance of Yb in the Earth's crust, $a_{Yb} = 3$ mg/kg $= 3 \cdot 10^{-6}$ g/g

  Density of Yb in the Earth's crust, $\rho_{crust} = 2.79$ g/cm^3

  Mass of Yb in the upper 3 km of the Earth's crust,
  $m_{Yb(\text{crust})} = a_{Yb} \cdot \rho_{crust} \cdot V_{crust} = 13.3 \cdot 10^{18}$ g

  Mass of Yb on land (considering that 71% of the Earth's surface is covered by water),
  $m_{Yb(\text{land})} = m_{Yb(\text{crust})} \cdot 0.29 = 3.86 \cdot 10^{18}$ g

- Potential surface coverage with Yb-based QC PV

  Ideal concentration of Yb for QC PV, $C_{Yb} = 7\%$

  Ideal thickness of a Yb-doped perovskite active layer,
  $t_{active\ layer} = 230$ nm $(= 2.3 \cdot 10^{-7}$m$)$

  Density of (Yb-doped) perovskite - e.g. $CsPbBr_3$,
  $\rho_{active\ layer} = 4.42$ g/cm^3 $(= 4.42 \cdot 10^3$ kg/m$^3)$

  Mass of Yb per m^2 of (230-nm-thick) PV material,
  $m_{Yb(PV)} = C_{Yb} \cdot t_{active\ layer} \cdot \rho_{active\ layer} = 7.11 \cdot 10^{-2}$ g

  Surface area coverable with Yb-based QC PV, $A_{PV(Yb)} = \frac{m_{Yb(\text{land})}}{m_{Yb(PV)}} = \mathbf{5.4 \cdot 10^{13}\ km^2}$.