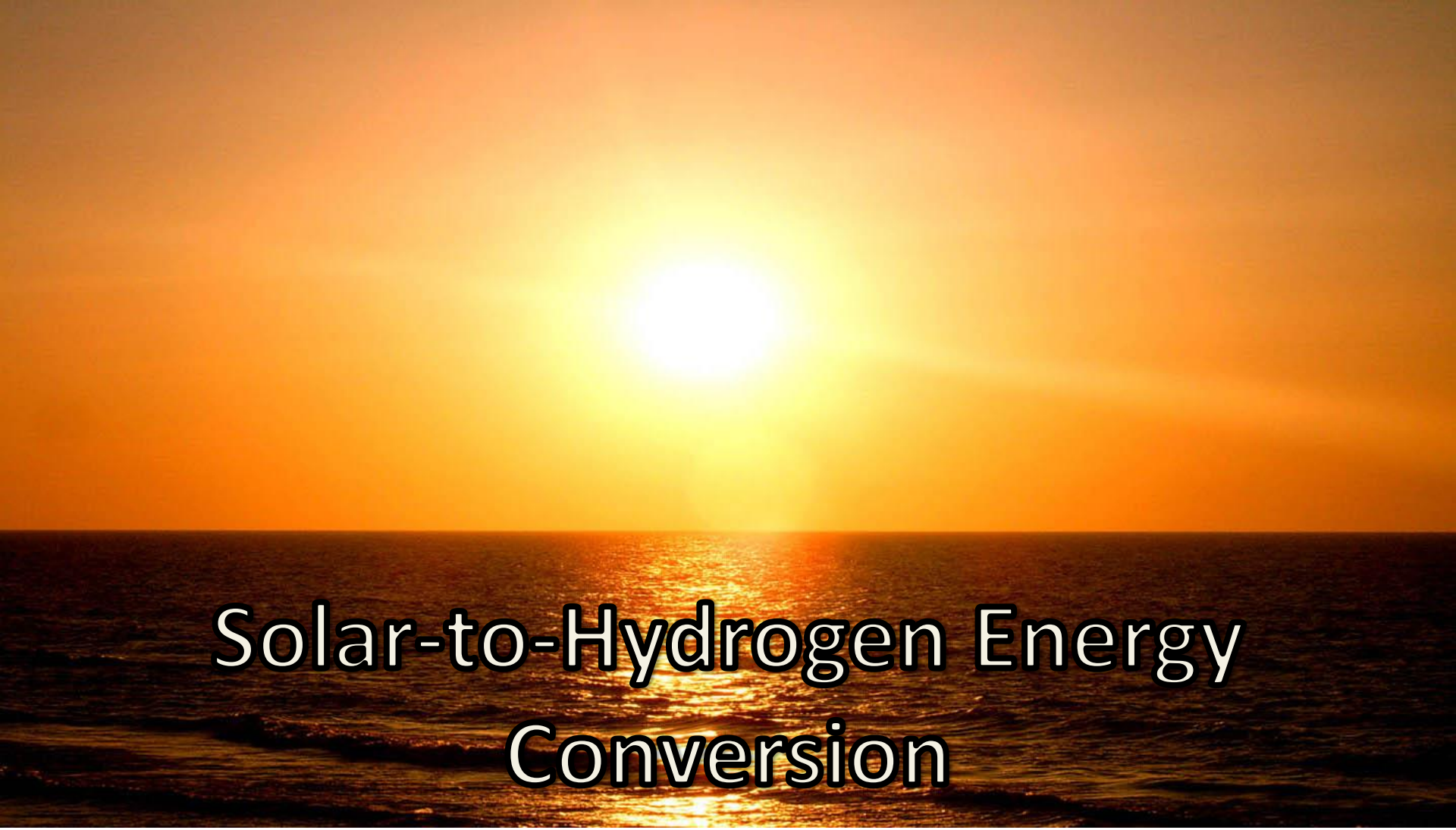


Solar-to-Hydrogen Energy Conversion

Polina V. Burmistrova

SBU Postdoc Spotlight, September 18, 2014

Why solar energy?

~14 TW (now) → **~40-50 TW** (by 2100)

Fossil-fuels economy

"Green" economy

Why solar energy?

~14 TW (now) → **~40-50 TW** (by 2100)

120,000 TW

~50,000 TW

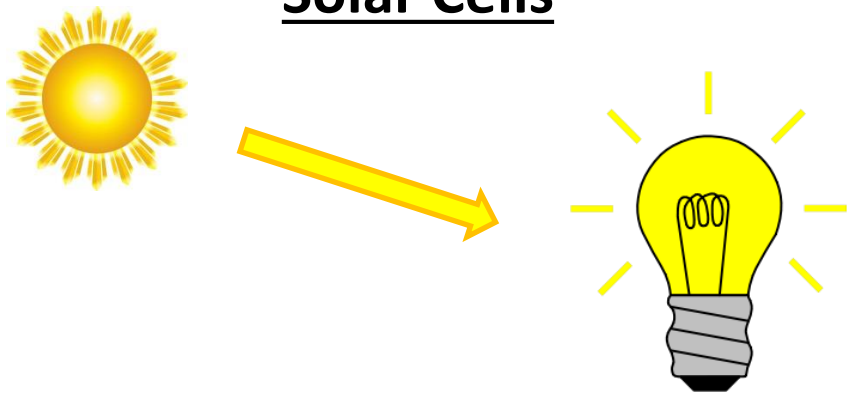
~80,000 TW absorbed

600 TW practical

Capture ***Conversion*** ***Storage***

Why solar energy?

Solar Cells



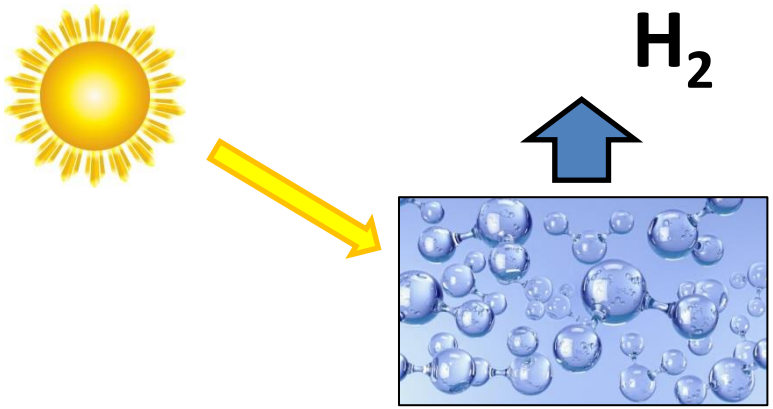
Direct solar-to-electrical conversion

~0.16% coverage at ~10% efficiency =<u>20 TW</u>

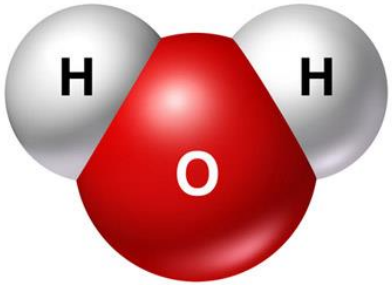
Square area required for 100% solar electricity in California

Works only at daylight

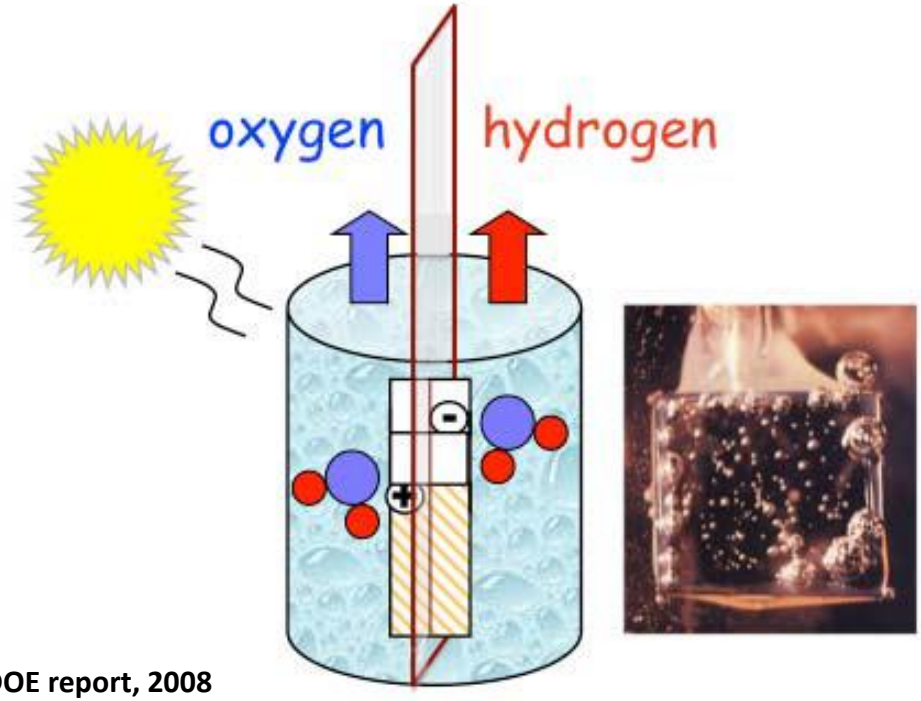
Solar water splitting

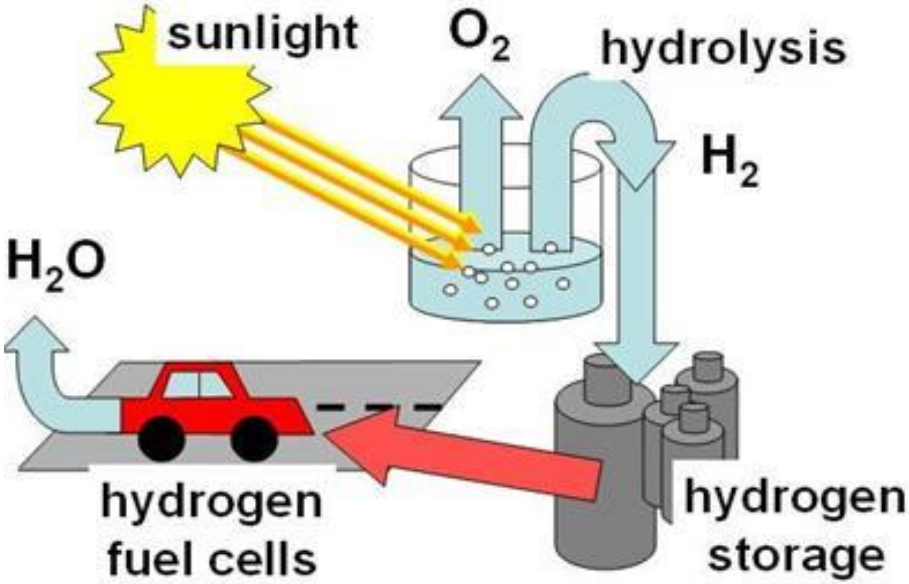


Water: H_2O



Direct solar-to-hydrogen conversion





$\Delta G^o = +273.18\ kJ\ mol^{-1}$

DOE report, 2008

Materials for solar water splitting

Oxides

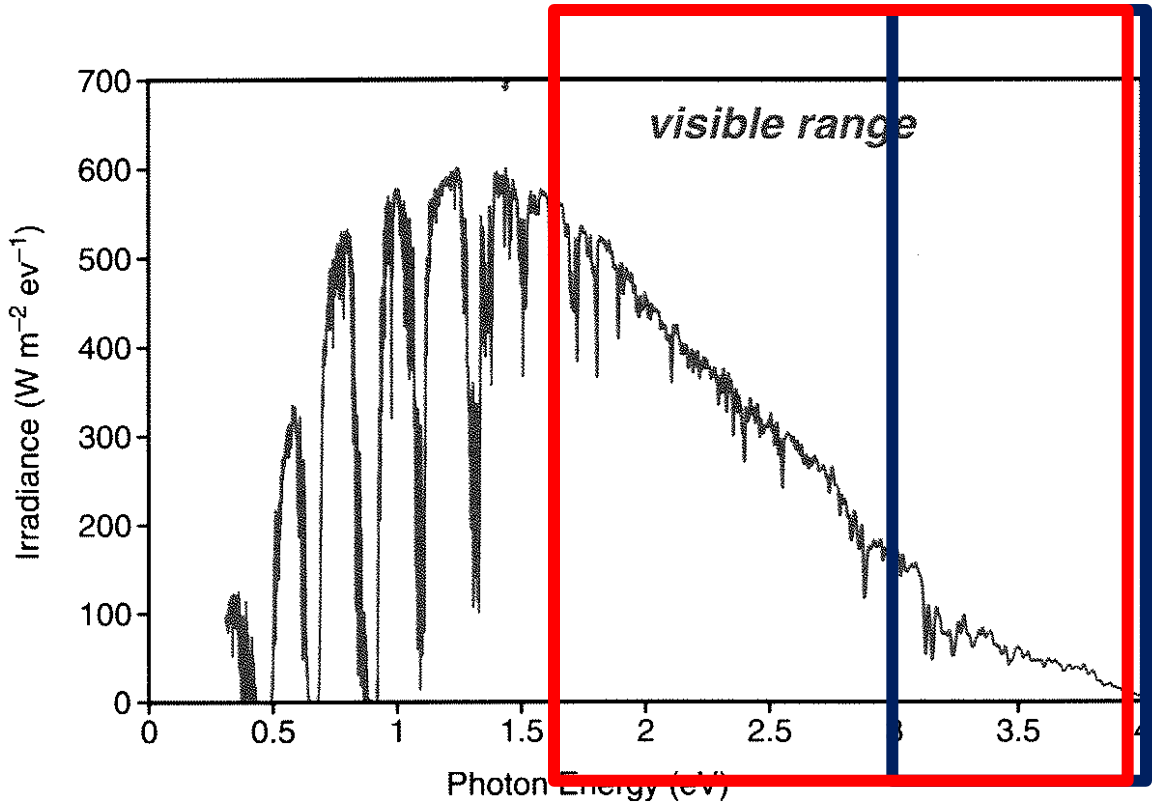
Titanium Dioxide (TiO_2),
Zink Oxide (ZnO)

Band gap > 3eV

Oxynitrides

Lanthanum Titanium oxinitride ($LaTiO_2N$)

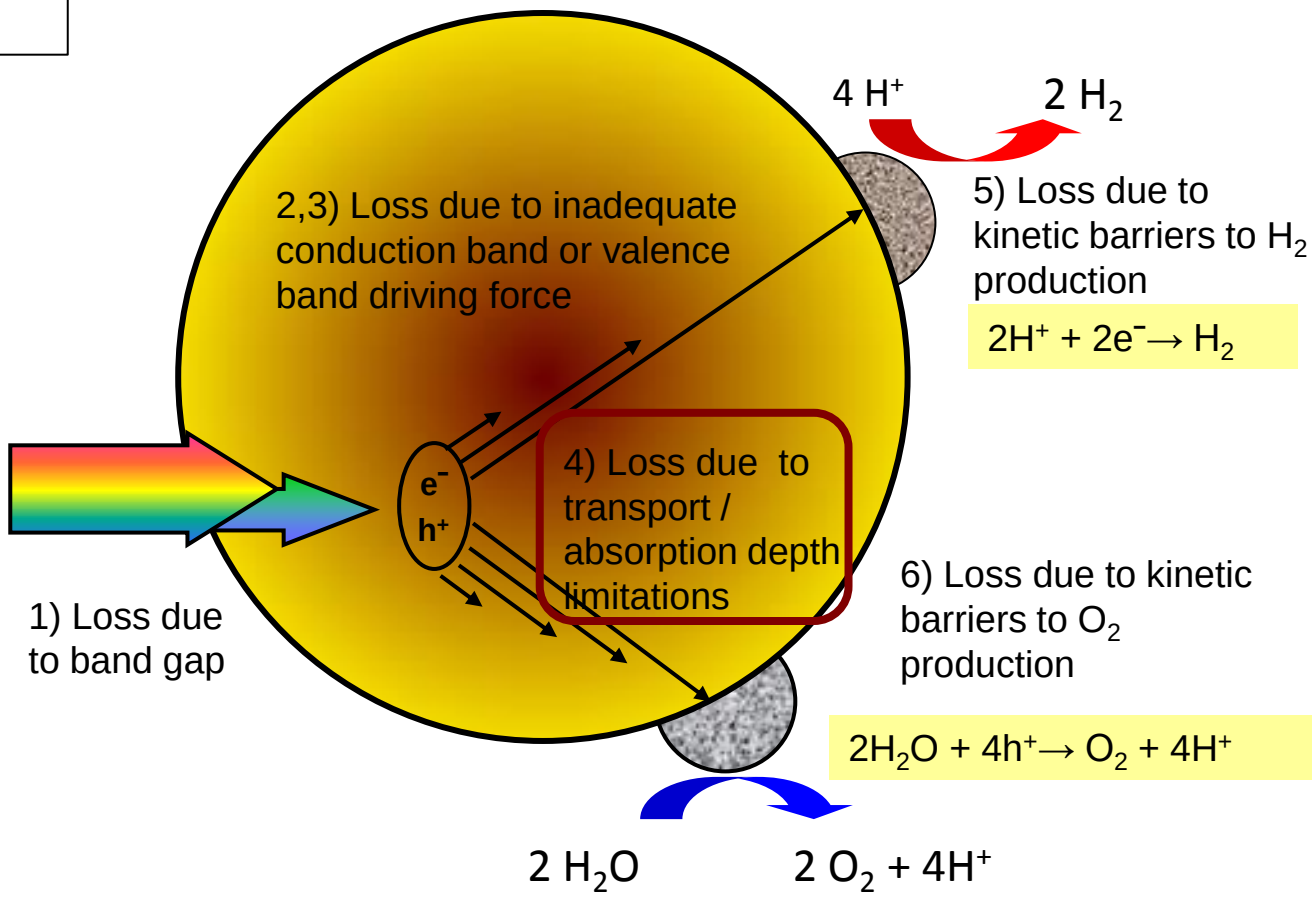
Need band gap < 3eV



Optimization needed

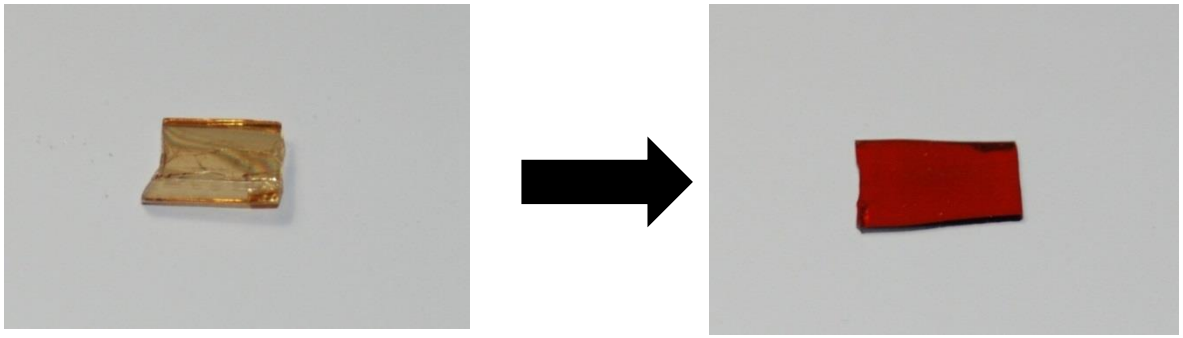
Solar water splitting

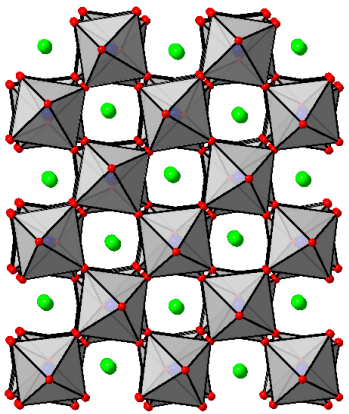
Six barriers to efficient solar water splitting



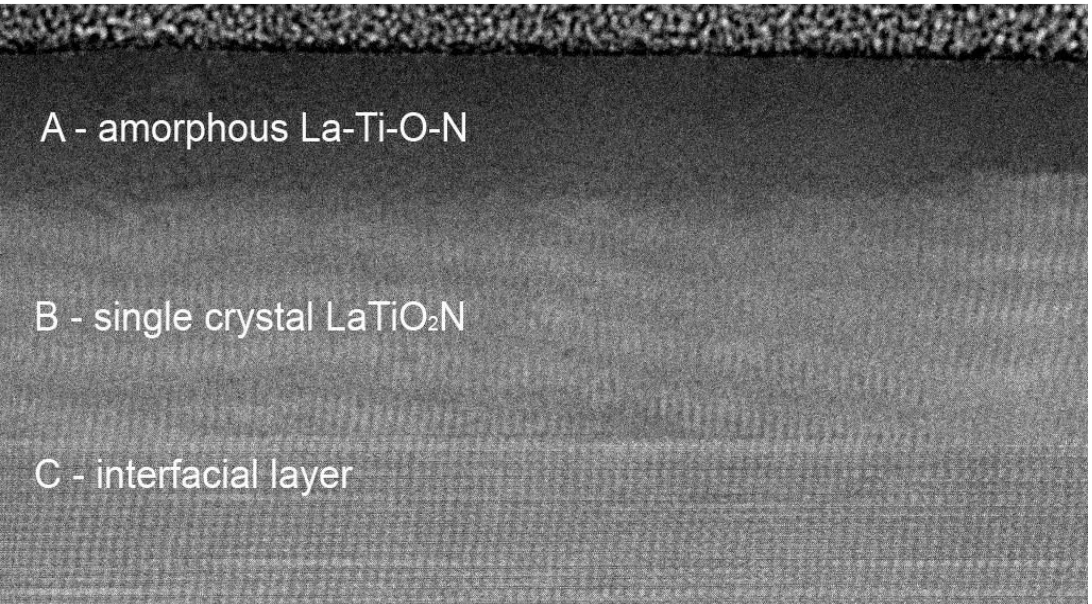
Lanthanum Titanium Oxynitride ($LaTiO_2N$)

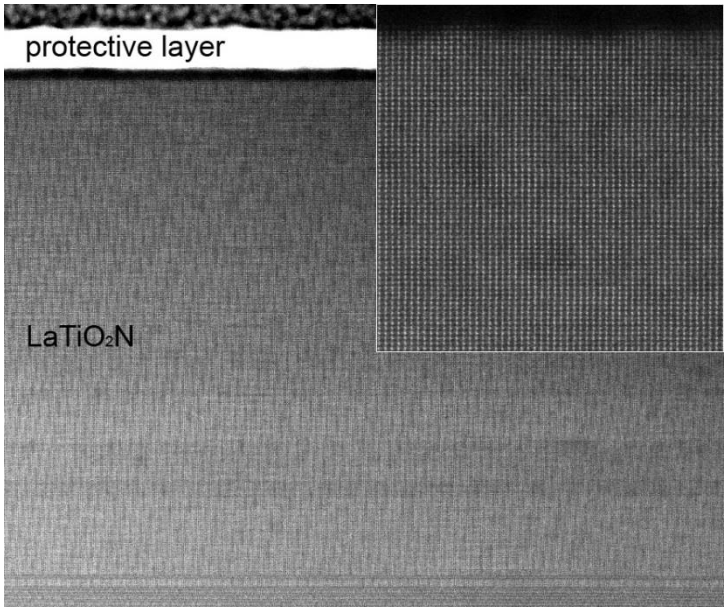
- ✓ **Obtained $LaTiO_2N$ thin films on insulating and conducting custom-made oxide crystals**





- ✓ **Studied optical properties and influence of microstructure of the films on the PEC activity**





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Group members and collaborators

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