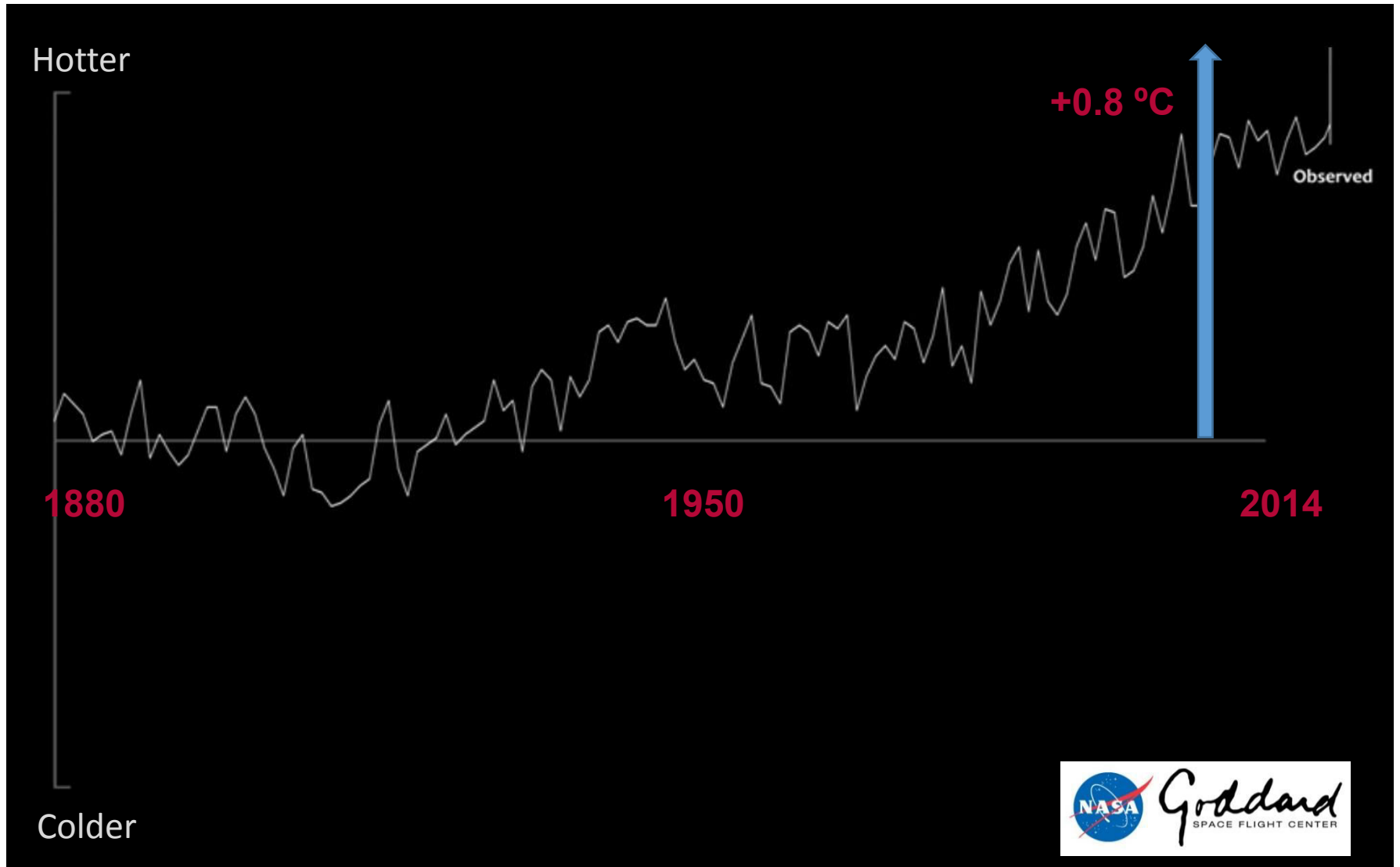


Photocatalytic reduction of CO₂ by means of TiO₂-based catalysts synthesized with high pressure fluids

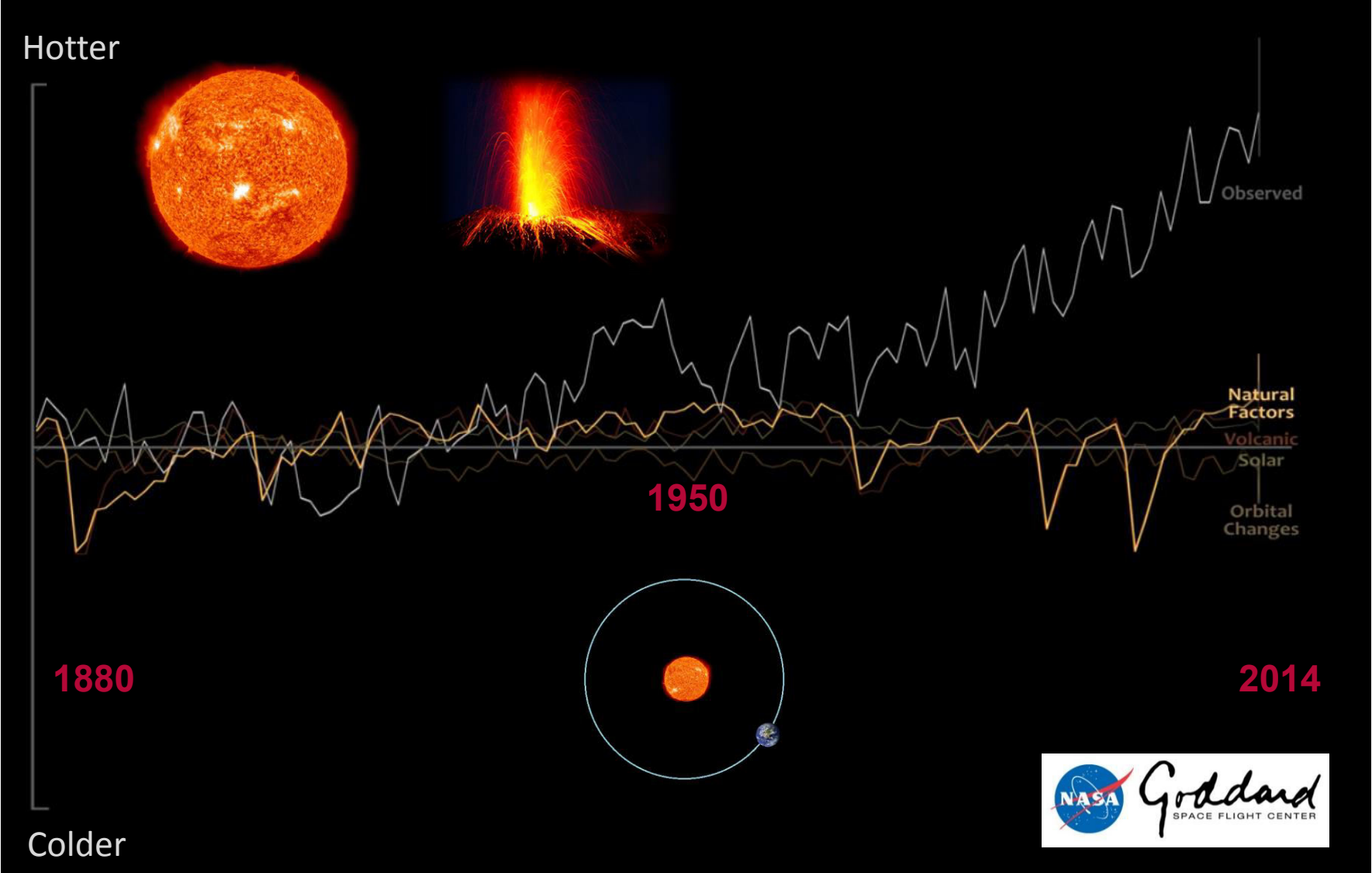
Rafael Camarillo Blas

rafael.camarillo@uclm.es

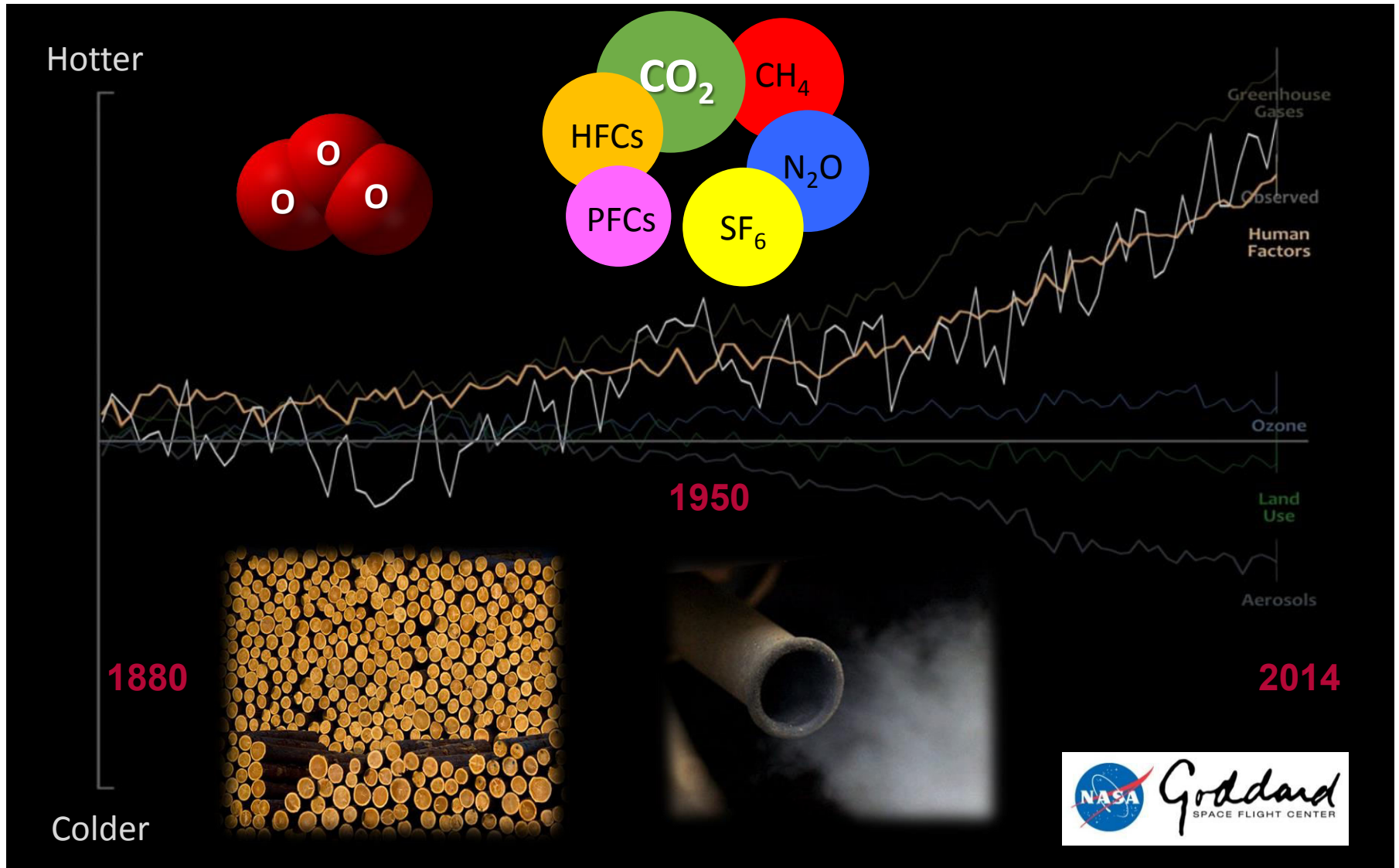
Average annual temperature

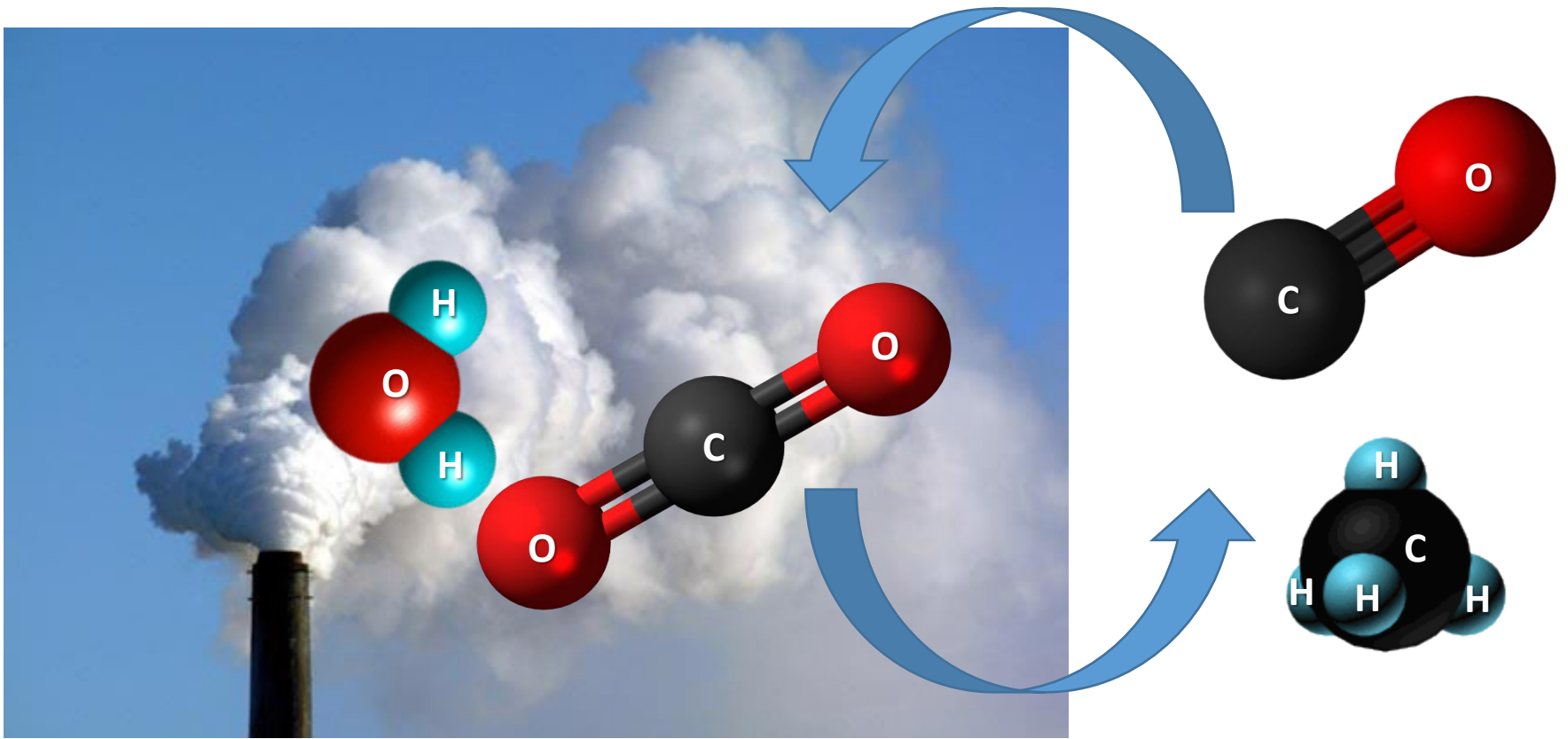


Natural factors

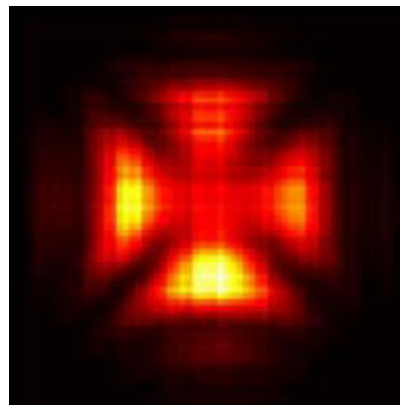


Human factors

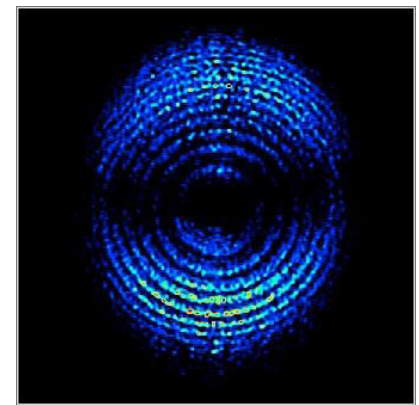




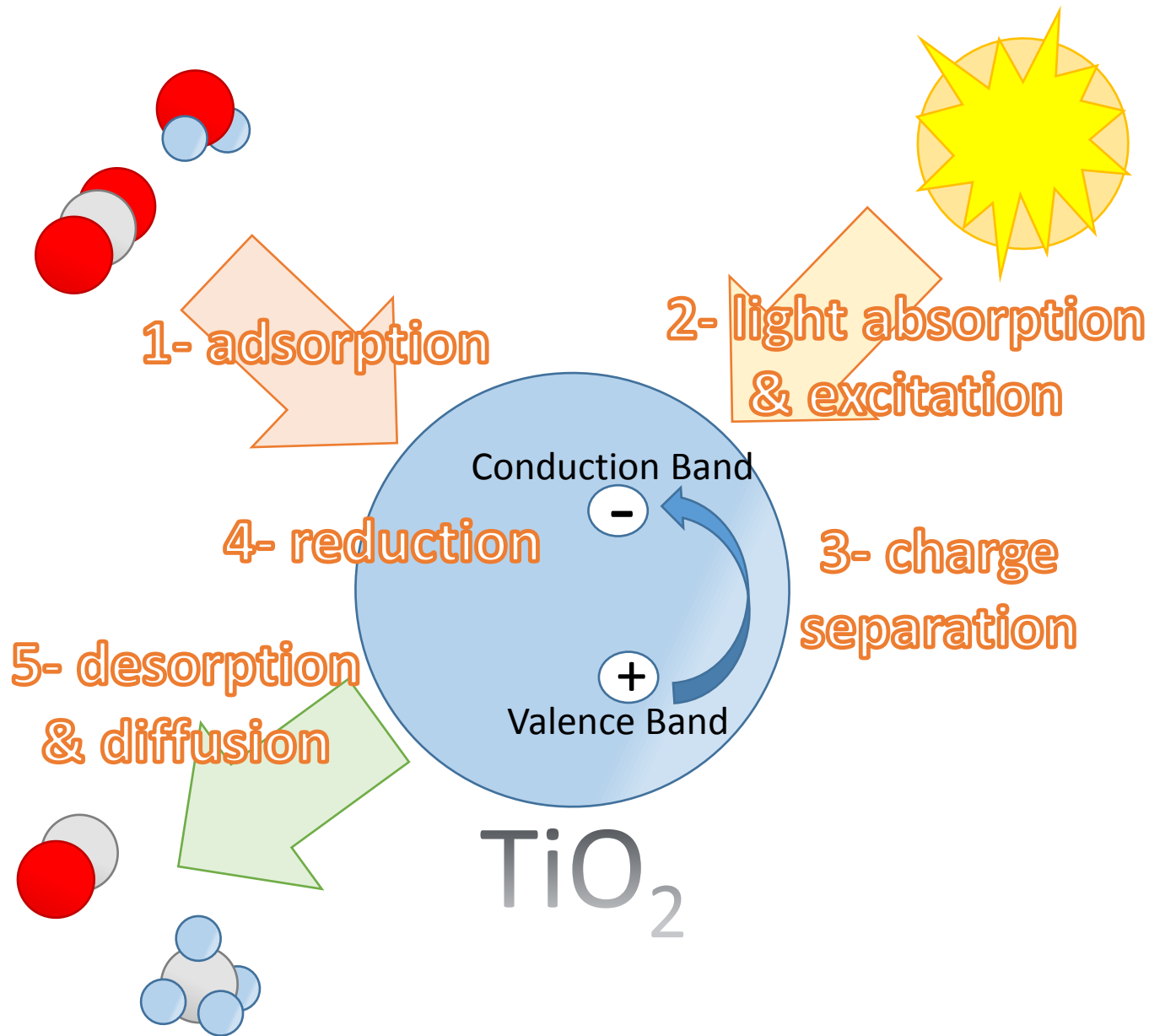
**Renewable
energy
sources**

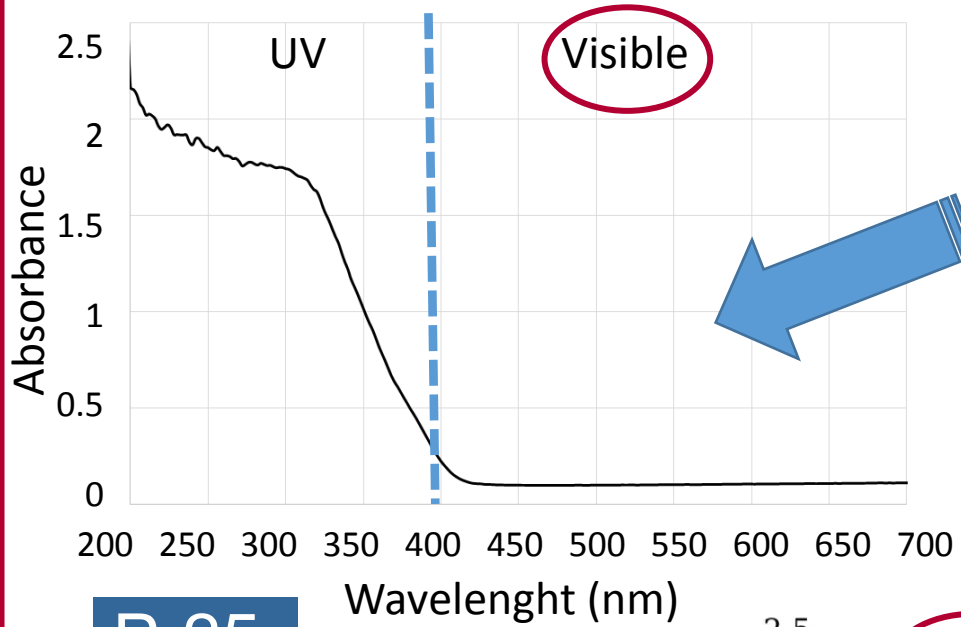


light



electricity

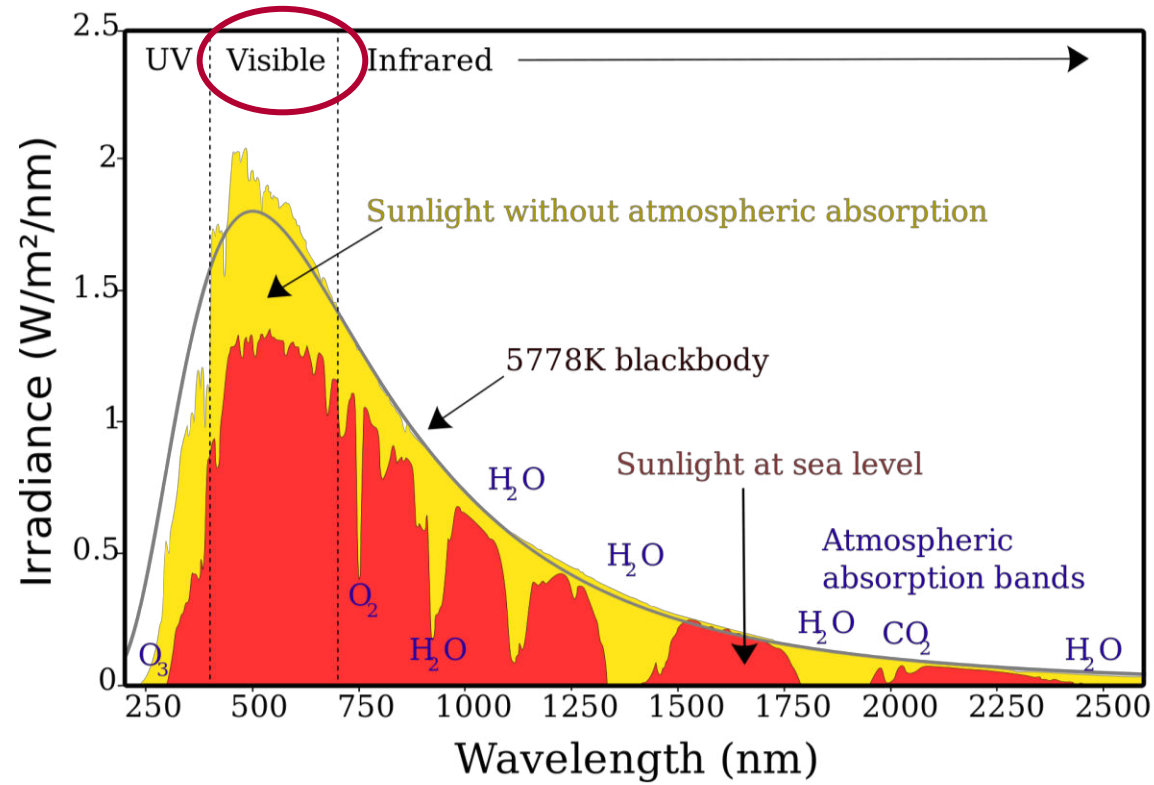




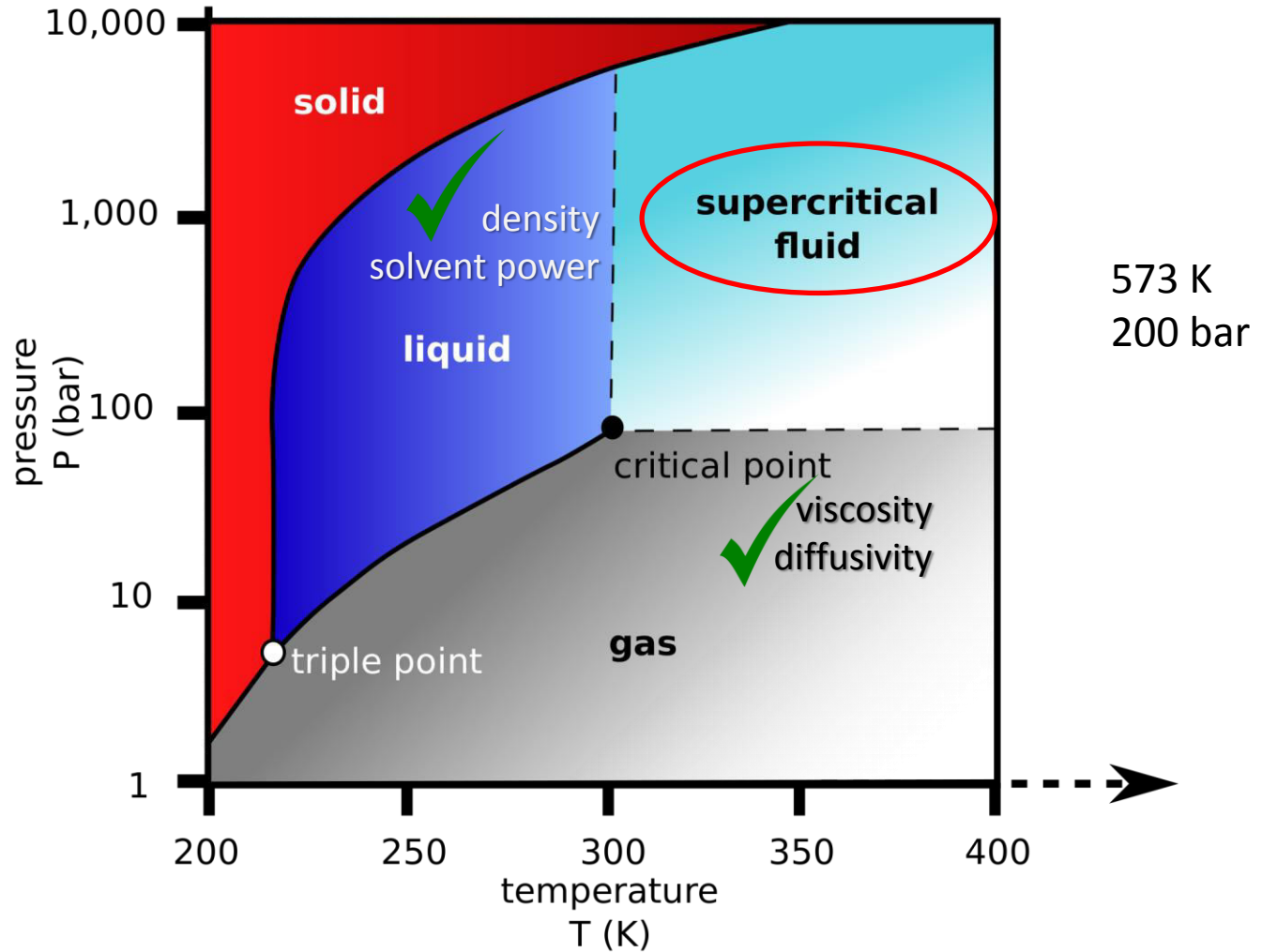
Band engineering

Solar radiation

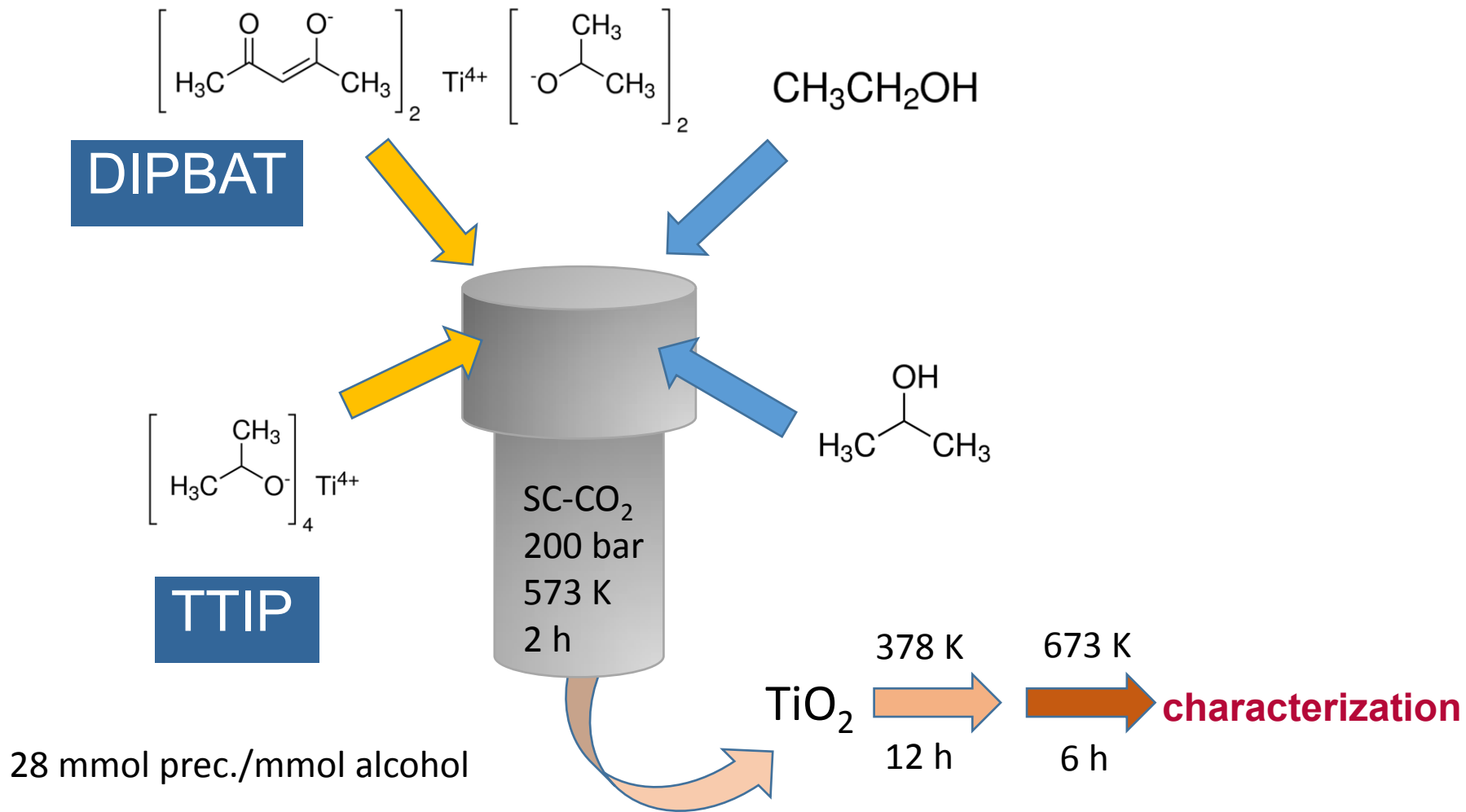
P-25



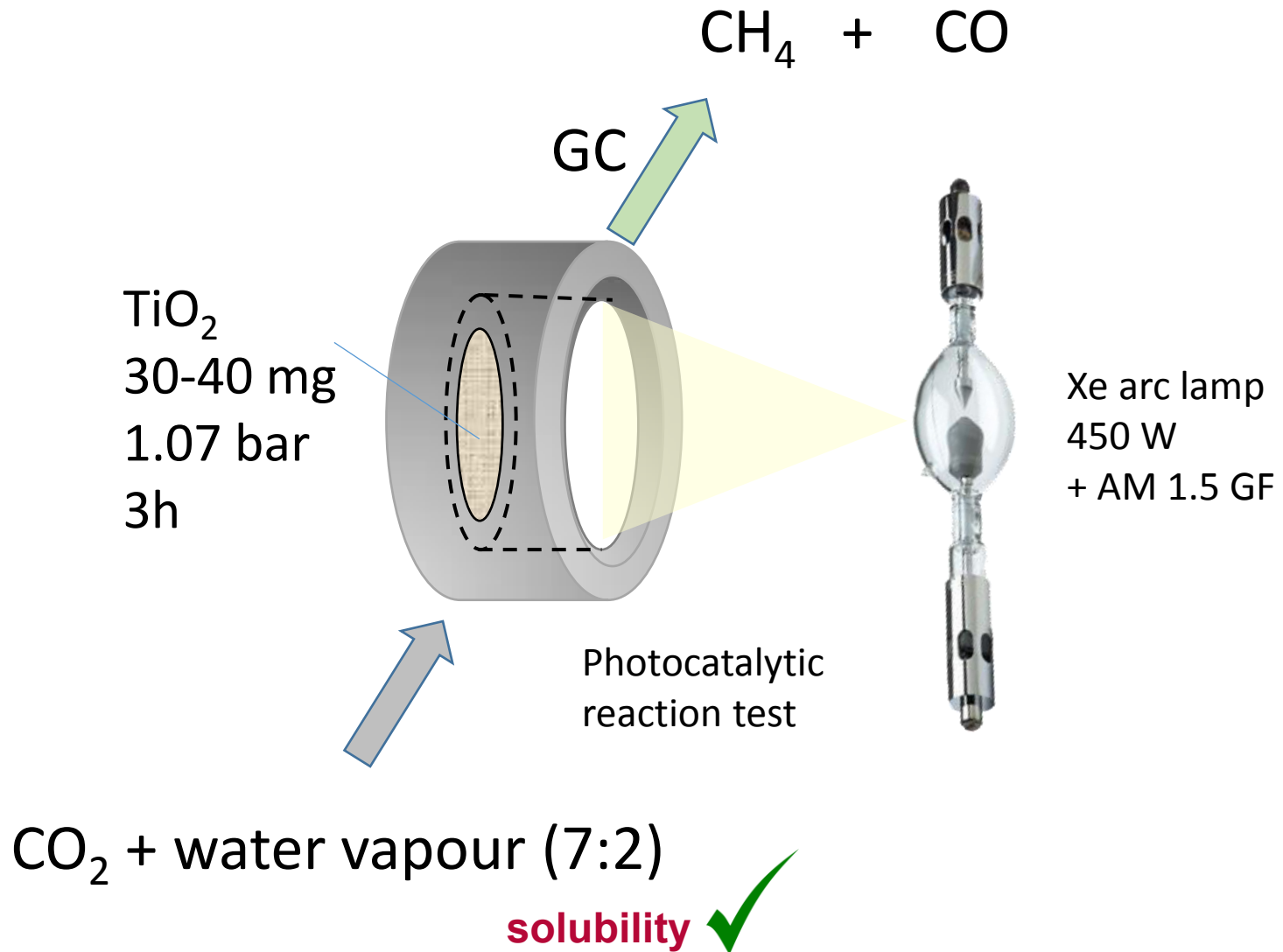
Phase diagram of CO₂



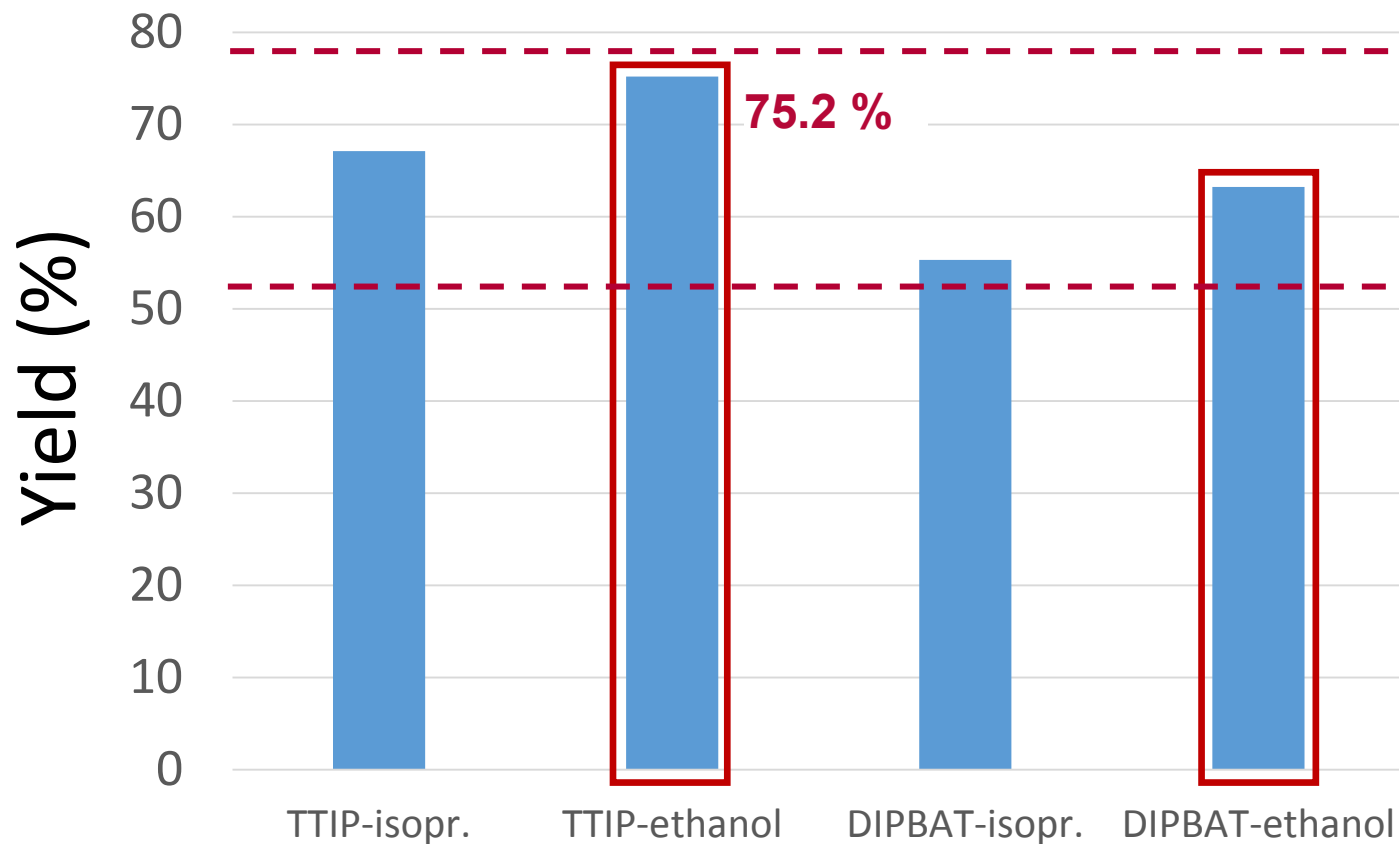
Synthesis of catalysts in high pressure fluids



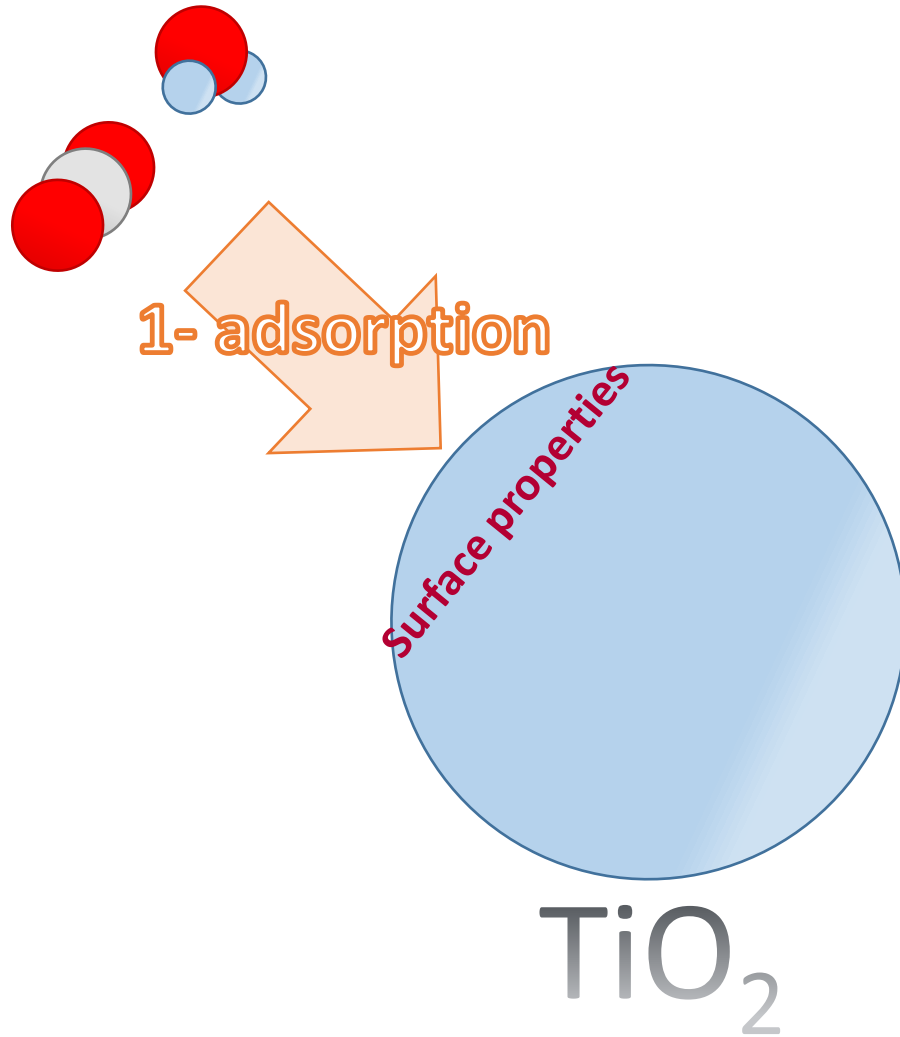
Photocatalytic reaction tests



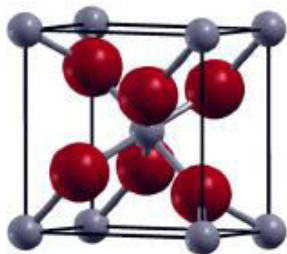
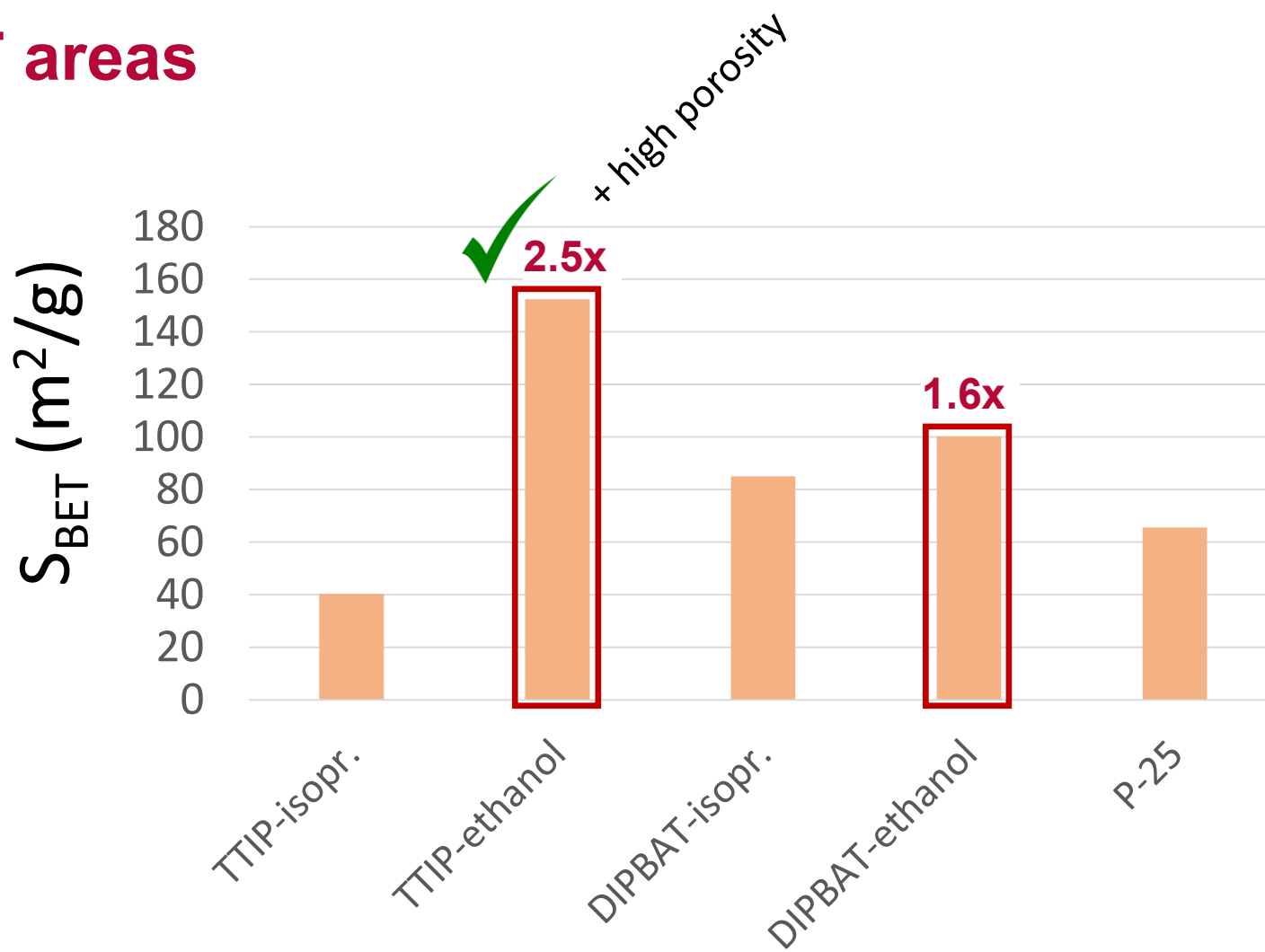
Synthesis yields



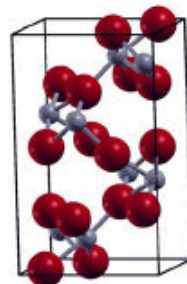
1 mol product : 1 mol precursor



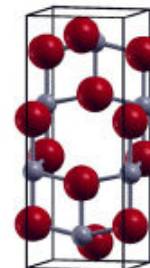
BET areas



Rutile
36-46
m²/g

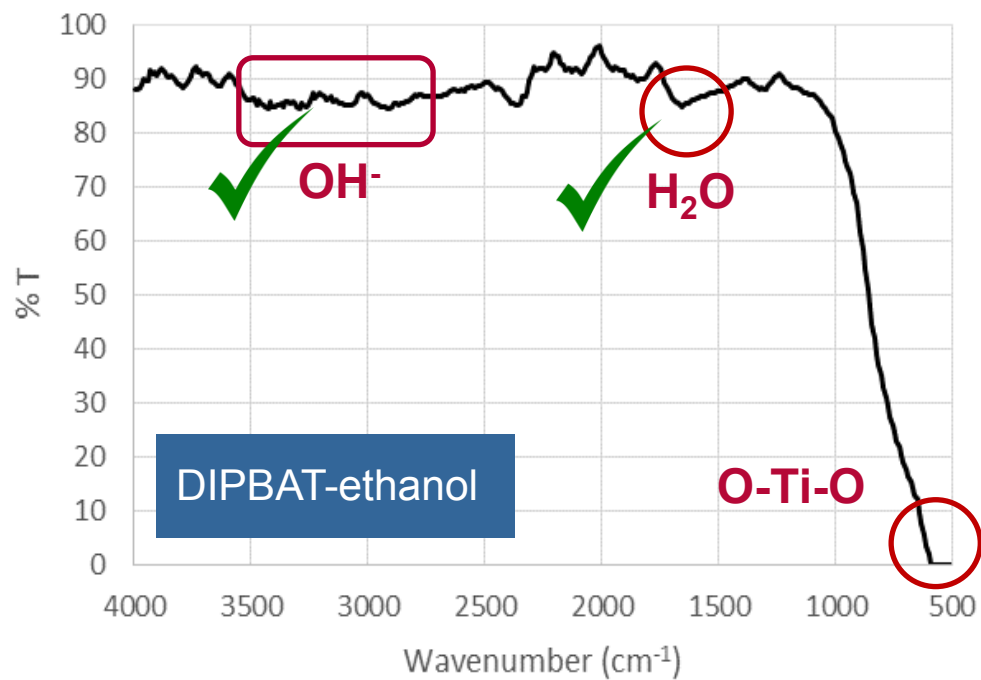
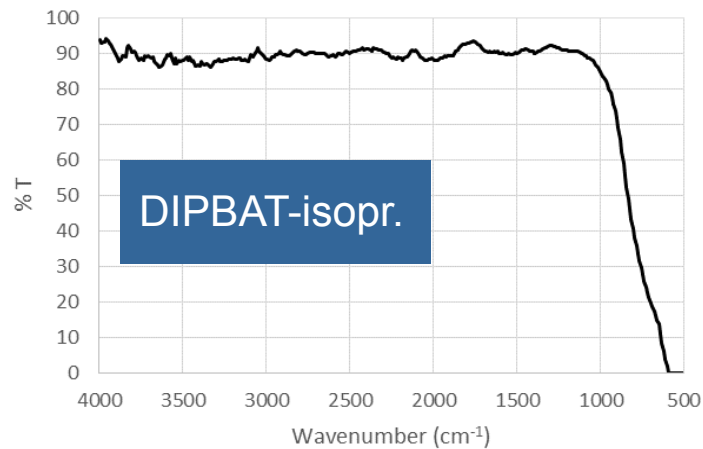
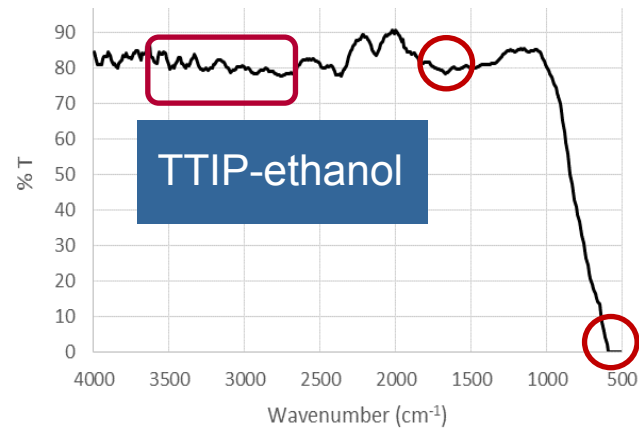
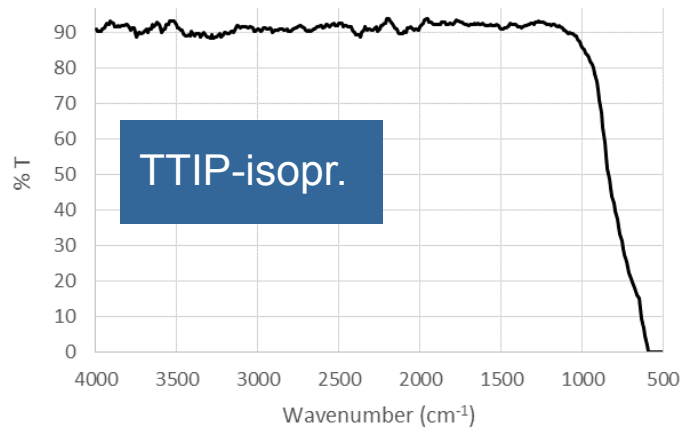


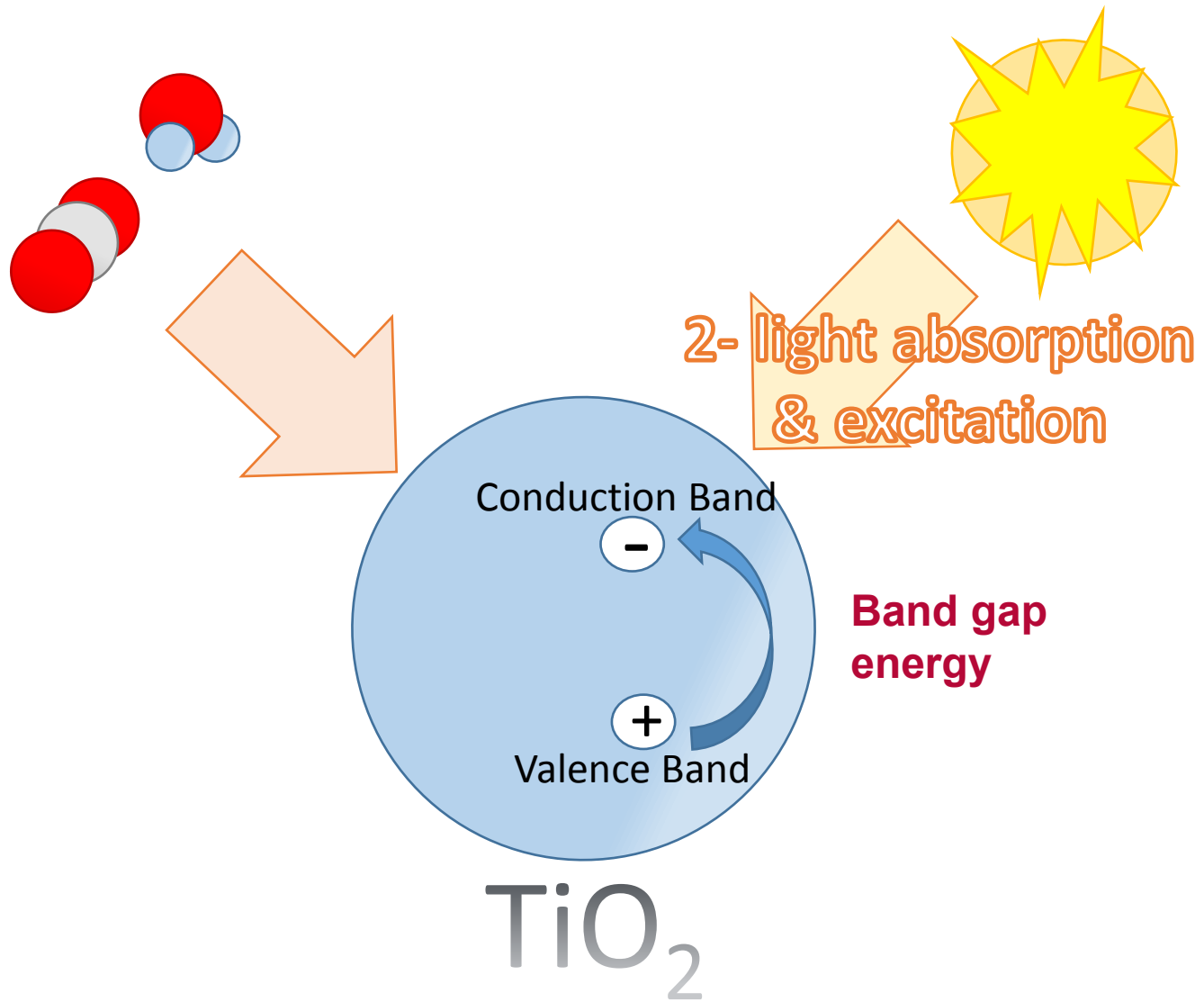
Brookite
76-87 m²/g



Anatase
145-163
m²/g

FTIR spectra

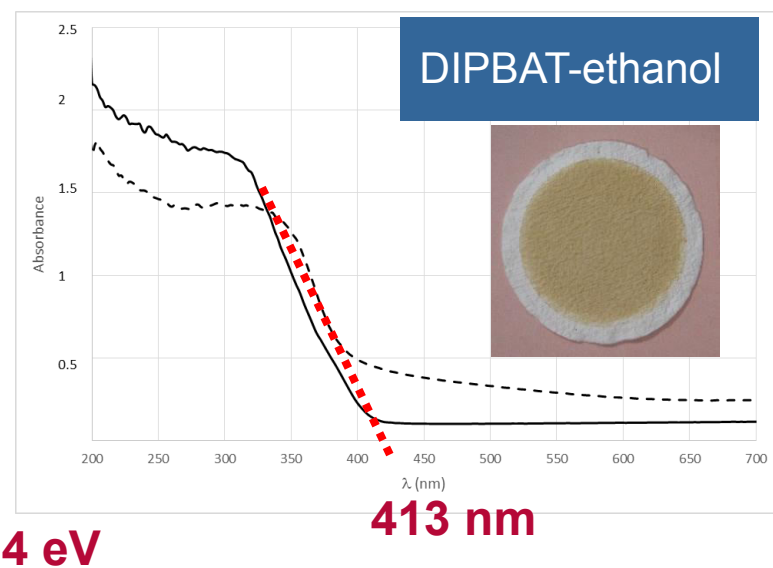
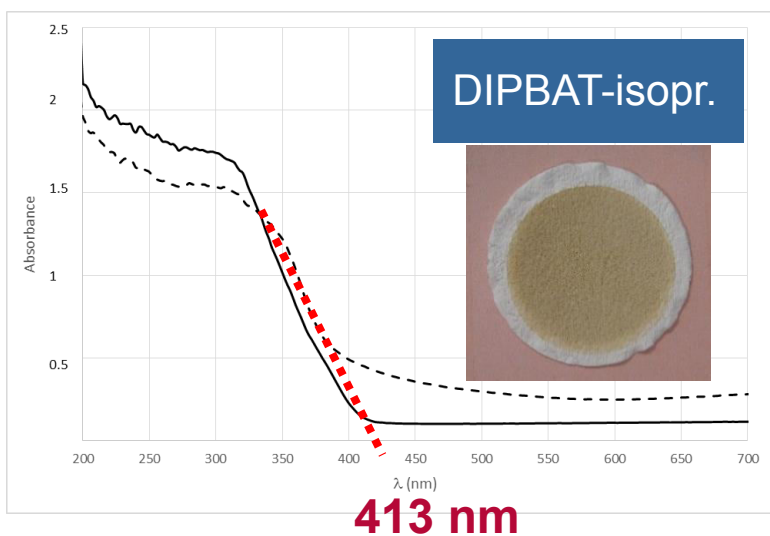
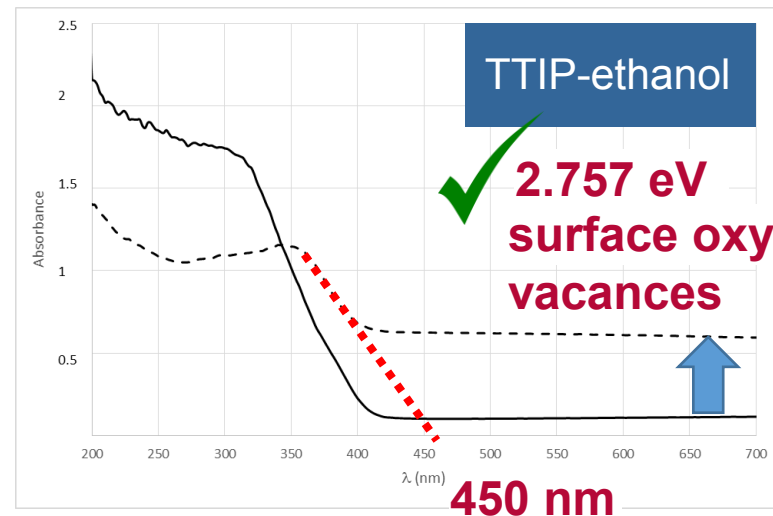
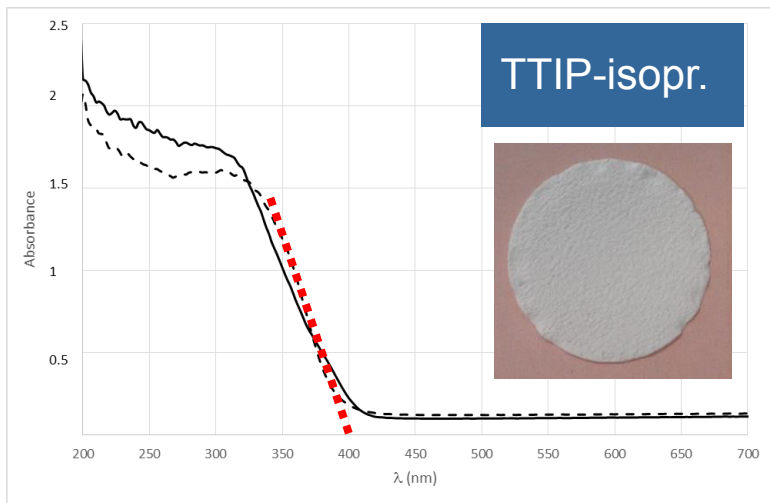


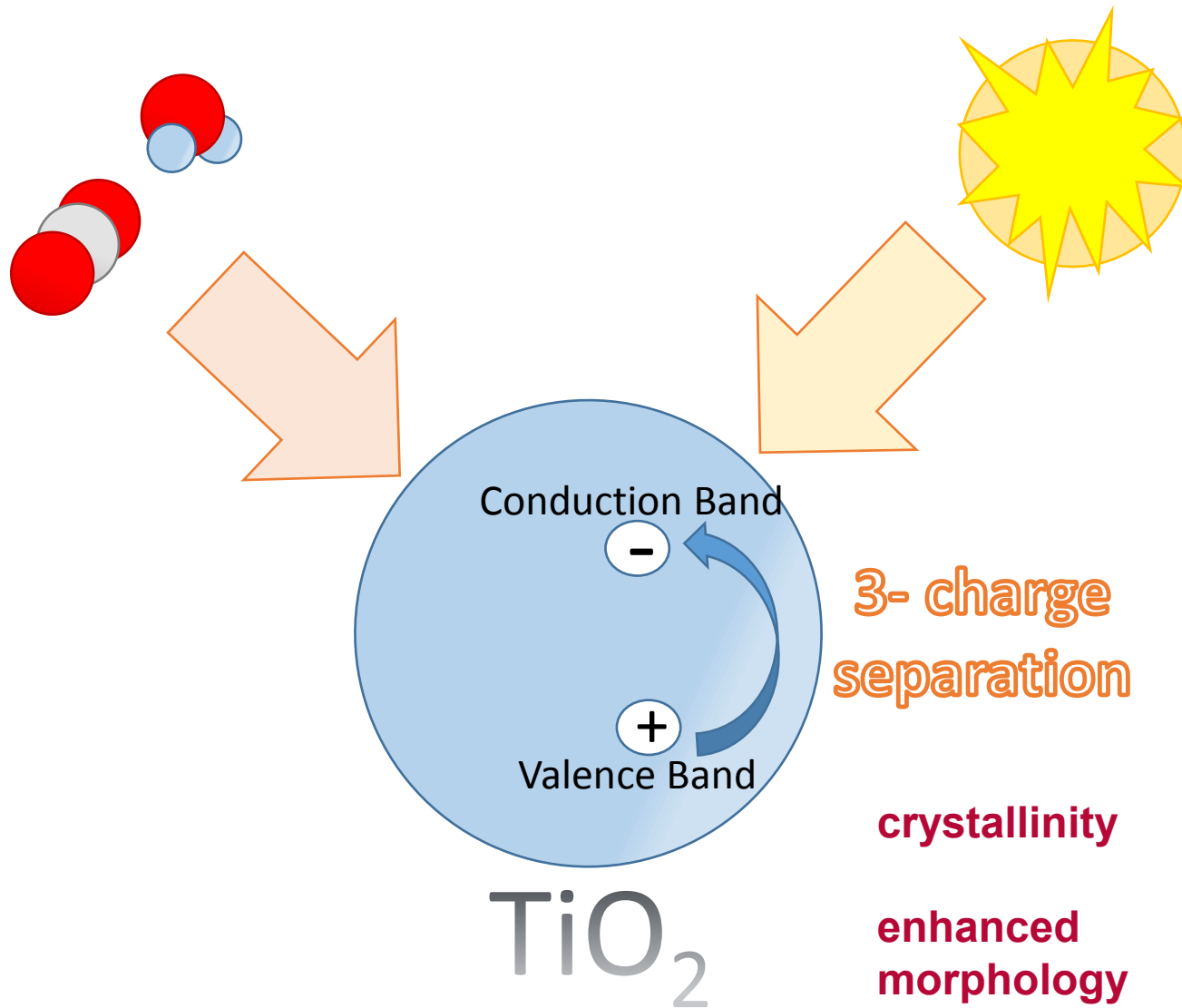


DRS spectra

P-25

3.048 eV (UV light)





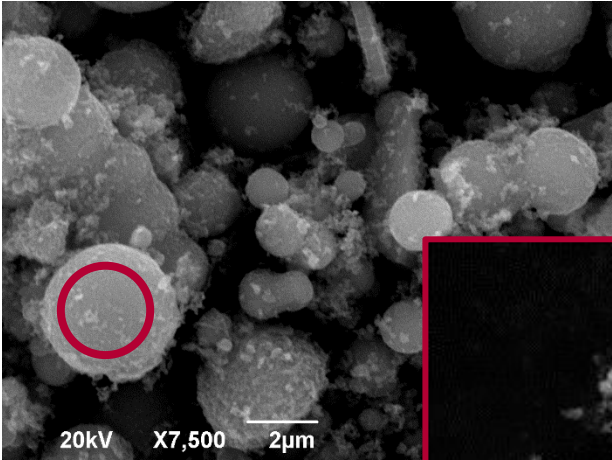
3- charge separation

crystallinity

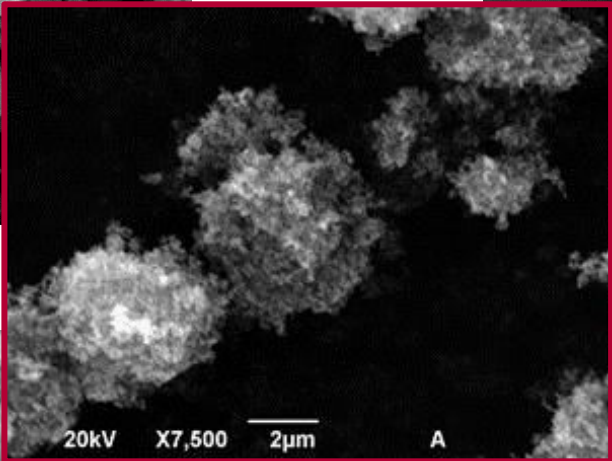
enhanced morphology

SEM images

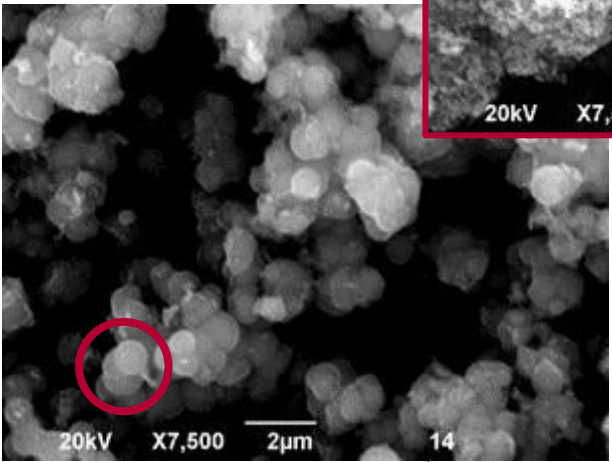
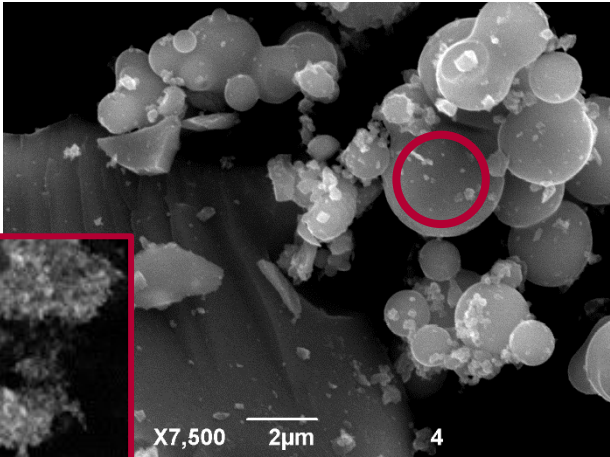
TTIP-isopr.



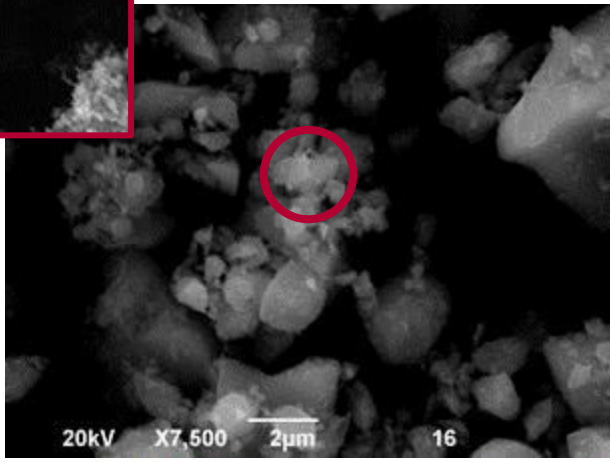
P-25



TTIP-ethanol

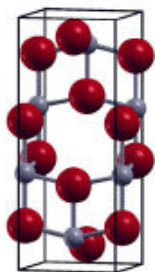


DIPBAT-isopr. ✓



DIPBAT-ethanol ✓

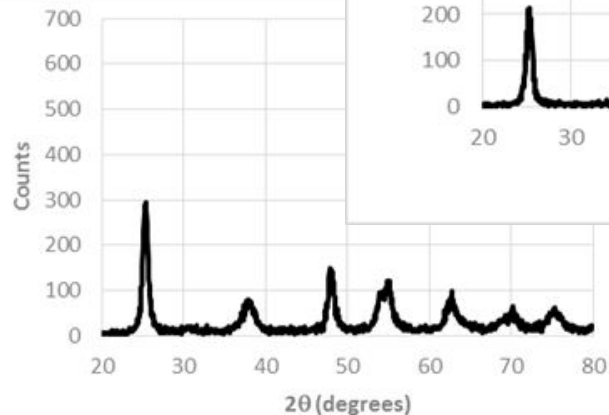
XRD diffractograms



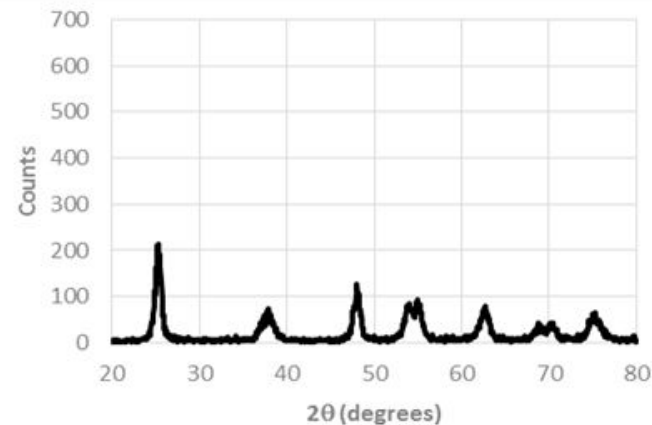
Anatase

10.65 nm

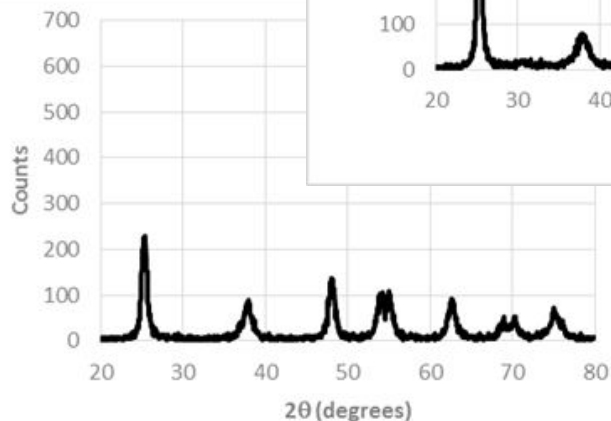
DIPBAT-isopr.



DIPBAT-ethanol

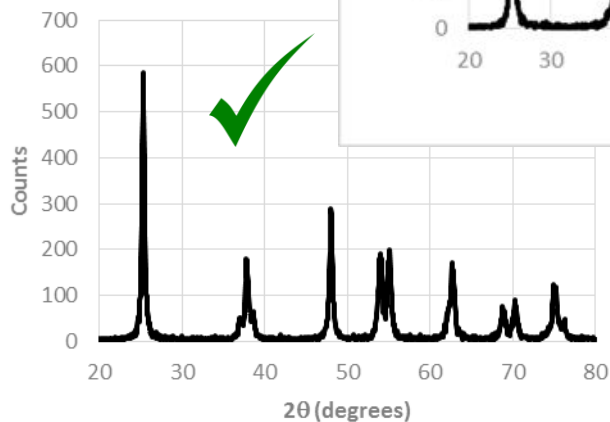


TTIP-ethanol



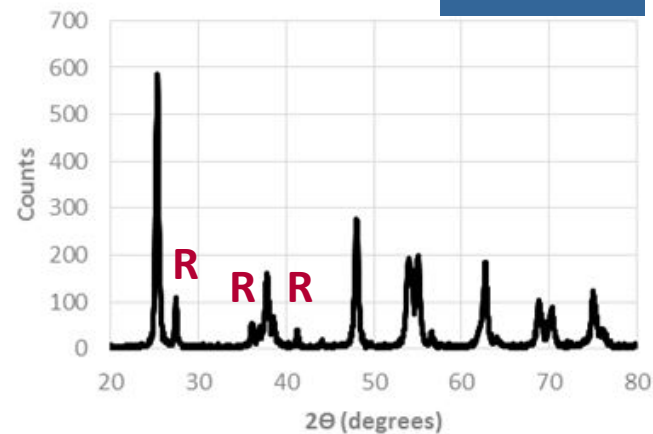
22.77 nm

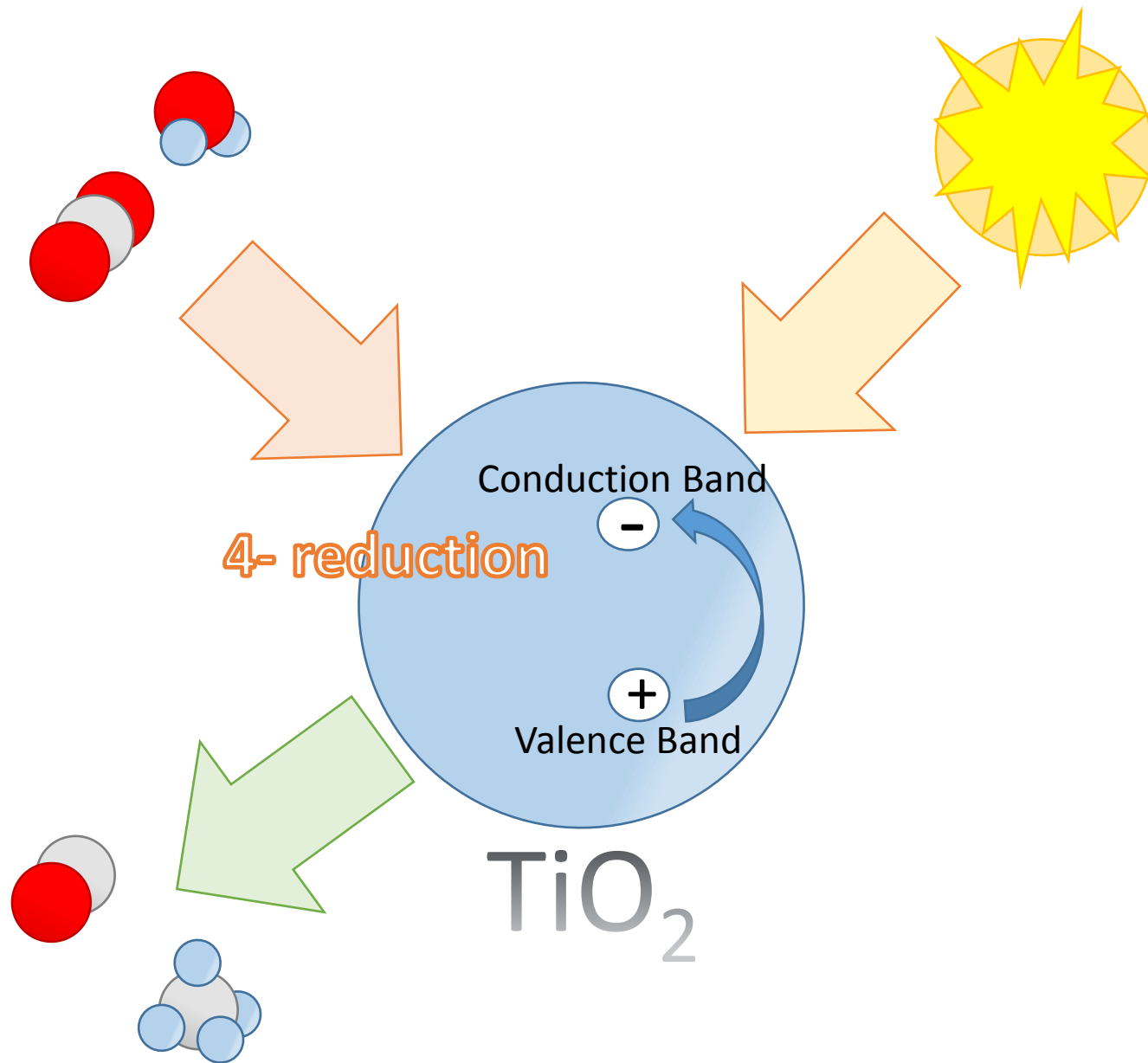
TTIP-isopr.



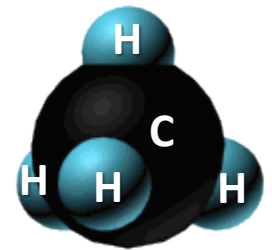
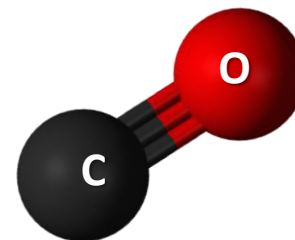
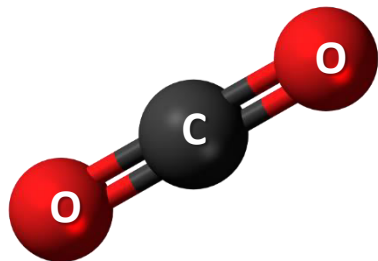
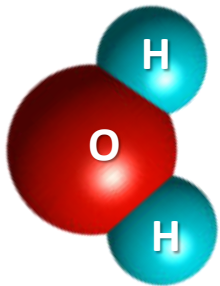
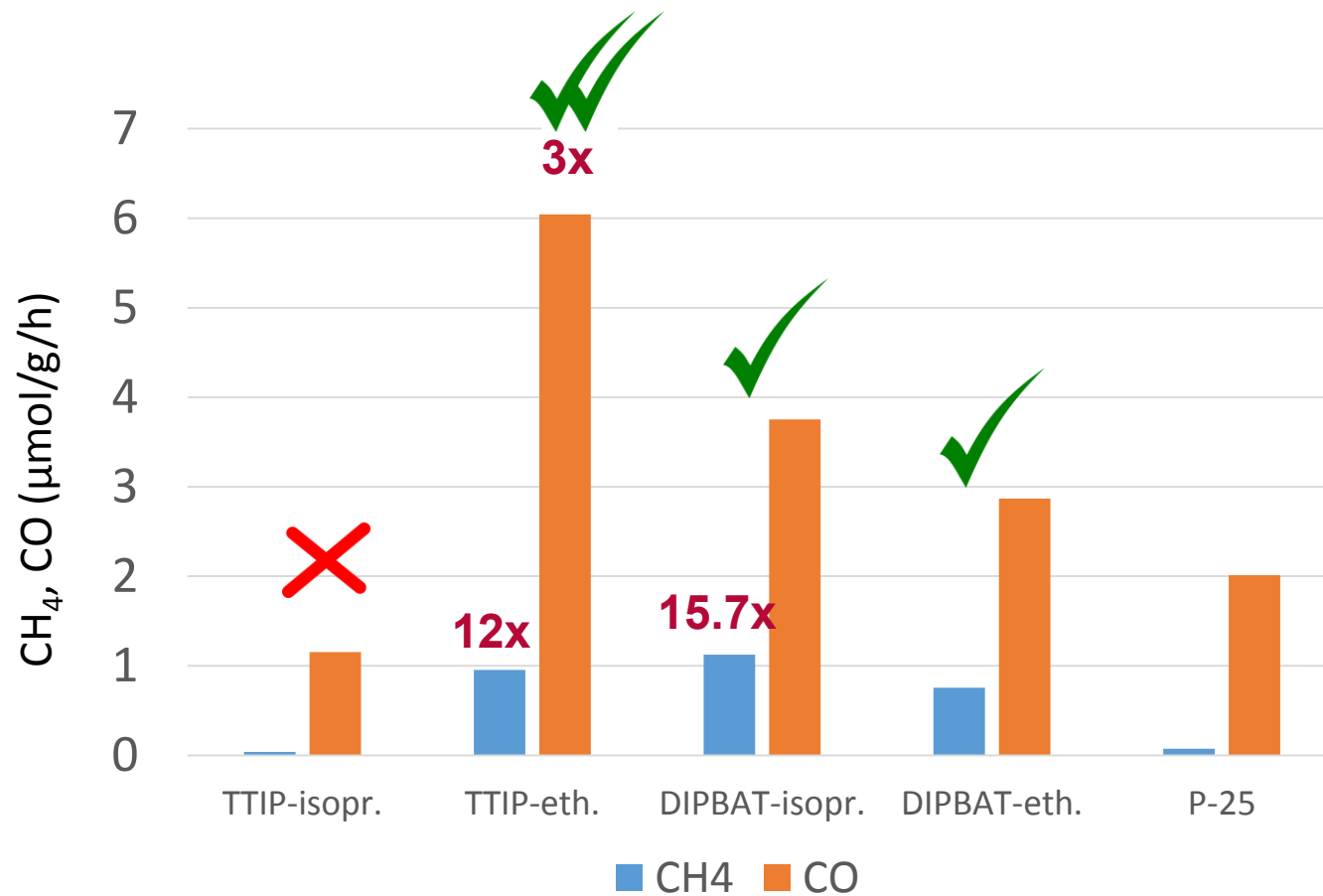
19.97 nm

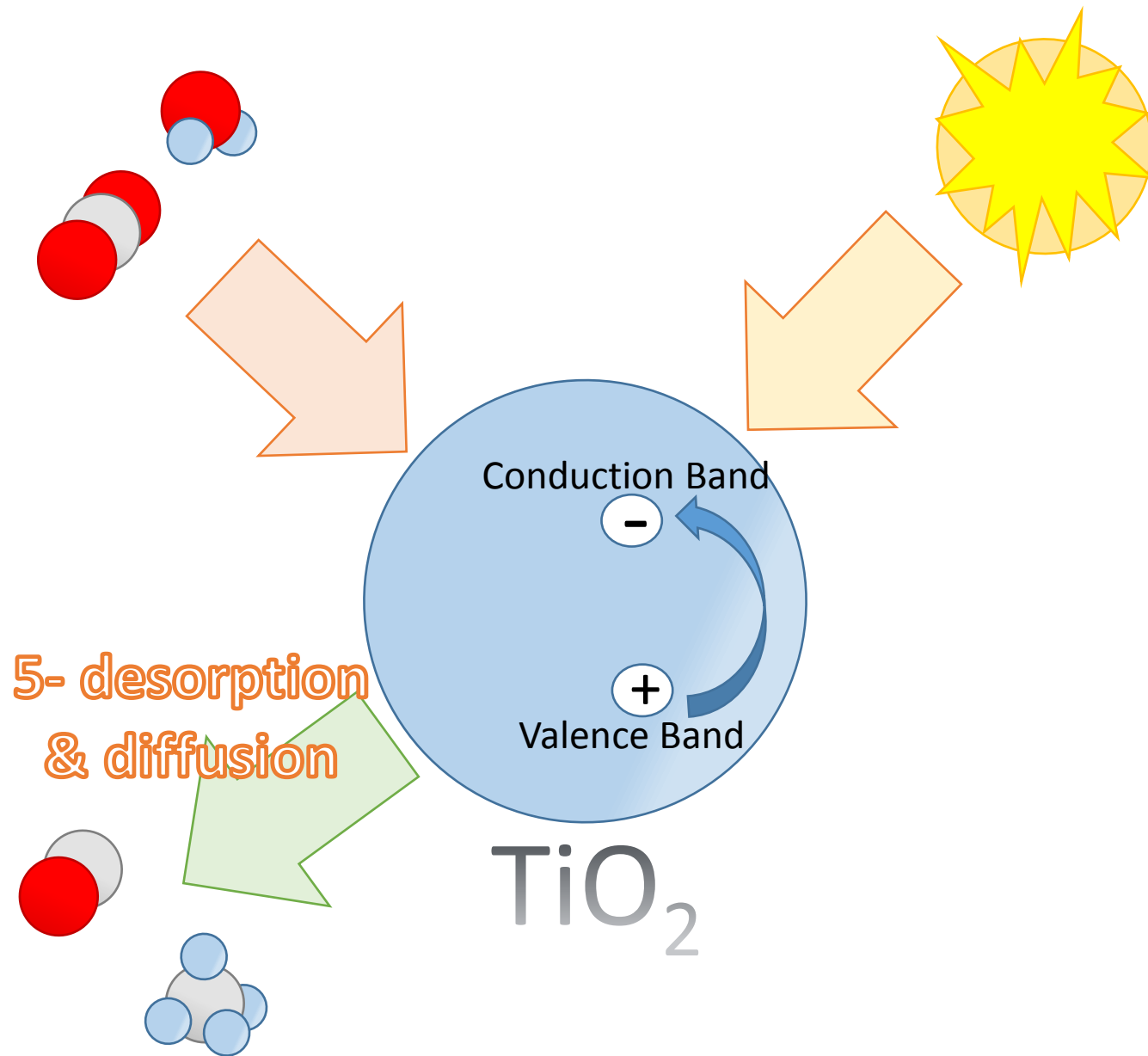
P-25





Photocatalytic reduction of CO₂





Conclusions

- Particles with SCFs: large BET areas, good porosity, active surface compositions, **narrow band gap, good visible light harvesting properties**, high crystallinity and purity, appropriate morphology
- Production rates are still far from industrial application
- Change in geometry (TNTs) and introduction of dopants (Cu, Pd, Pt)

Acknowledgments



CTM2011-26564



Castilla-La Mancha

PEI10-0310-5840



Fundación

**IBERDROLA
ESPAÑA**

Energy & Environment 2010/12

Acknowledgments



INQUIME Group



Carlos
Jiménez

Fabiola
Martínez

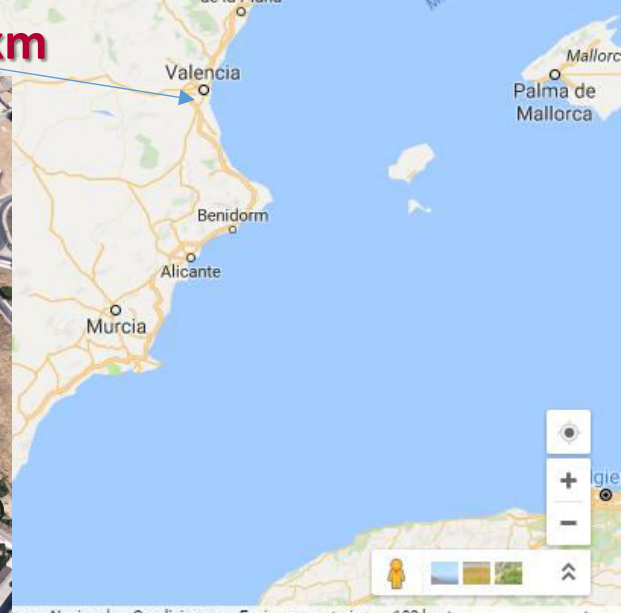
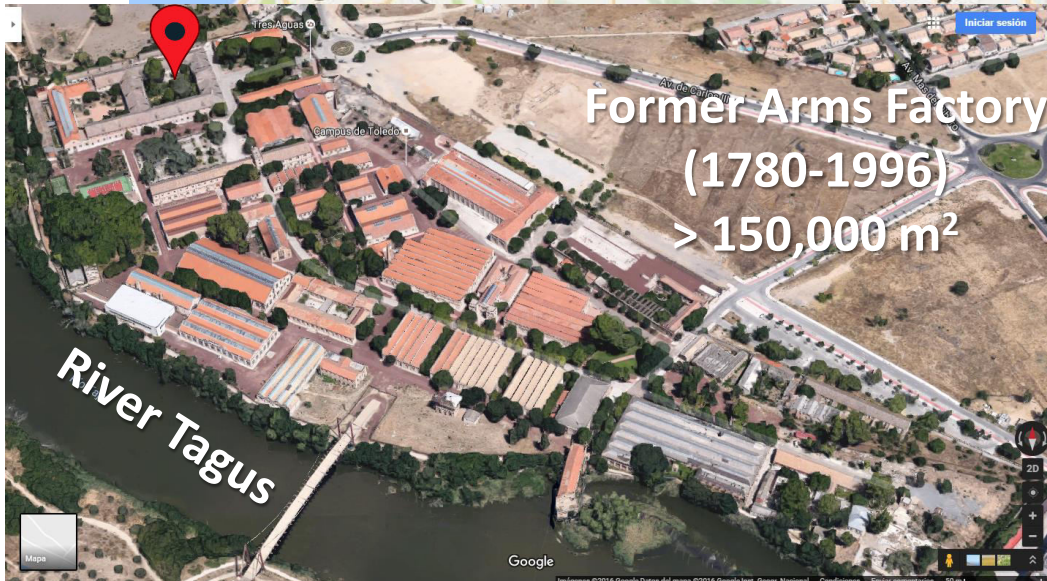
Jesús
García

Isaac
Asencio

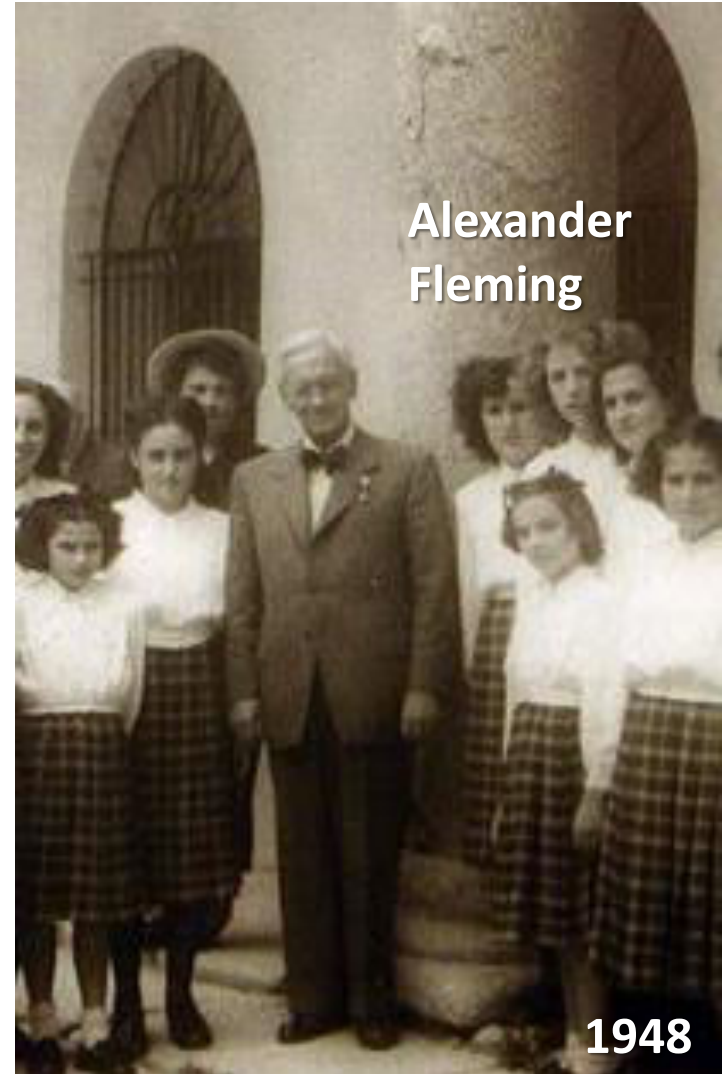
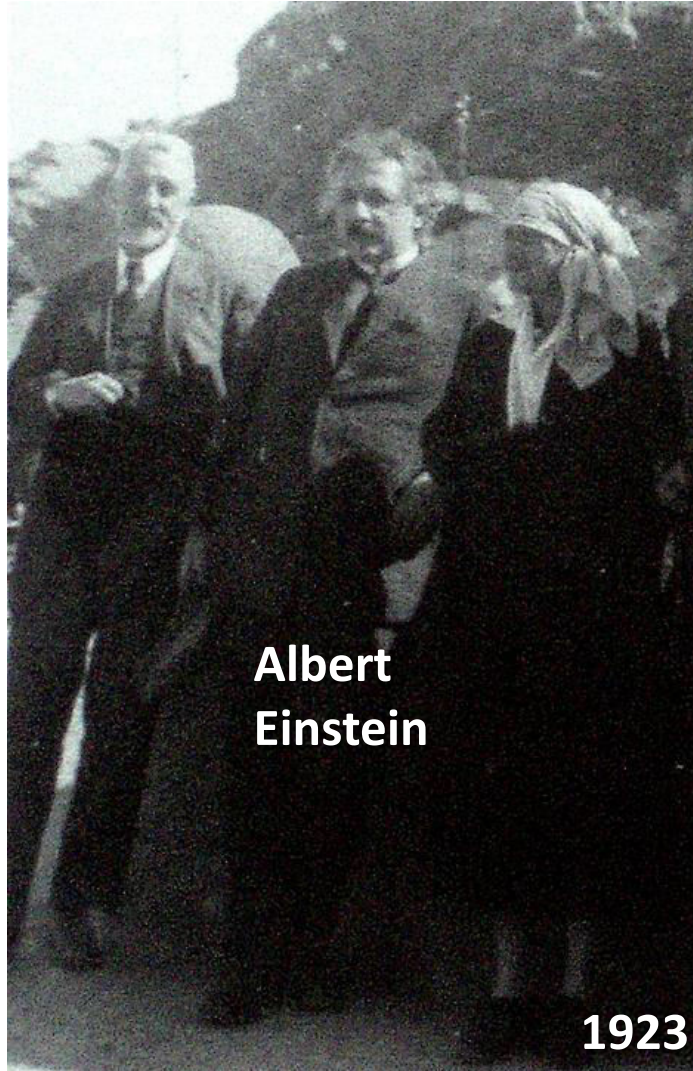
Jesusa
Rincón

Susana
Tostón

Acknowledgments



Acknowledgments



Acknowledgments



1986-2016



טולדות

TOLETVM

طليطلة

Photocatalytic reduction of CO₂ by means of TiO₂-based catalysts synthesized with high pressure fluids

Rafael Camarillo Blas

rafael.camarillo@uclm.es