Femtosecond laser processing of titanium for photocatalysis

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Photonics West 2011

VARTA
AccuPlus
Nickel-Cadmium
VARTA
AccuPlus
Ni-Cd
Cd

Why TiO_2?

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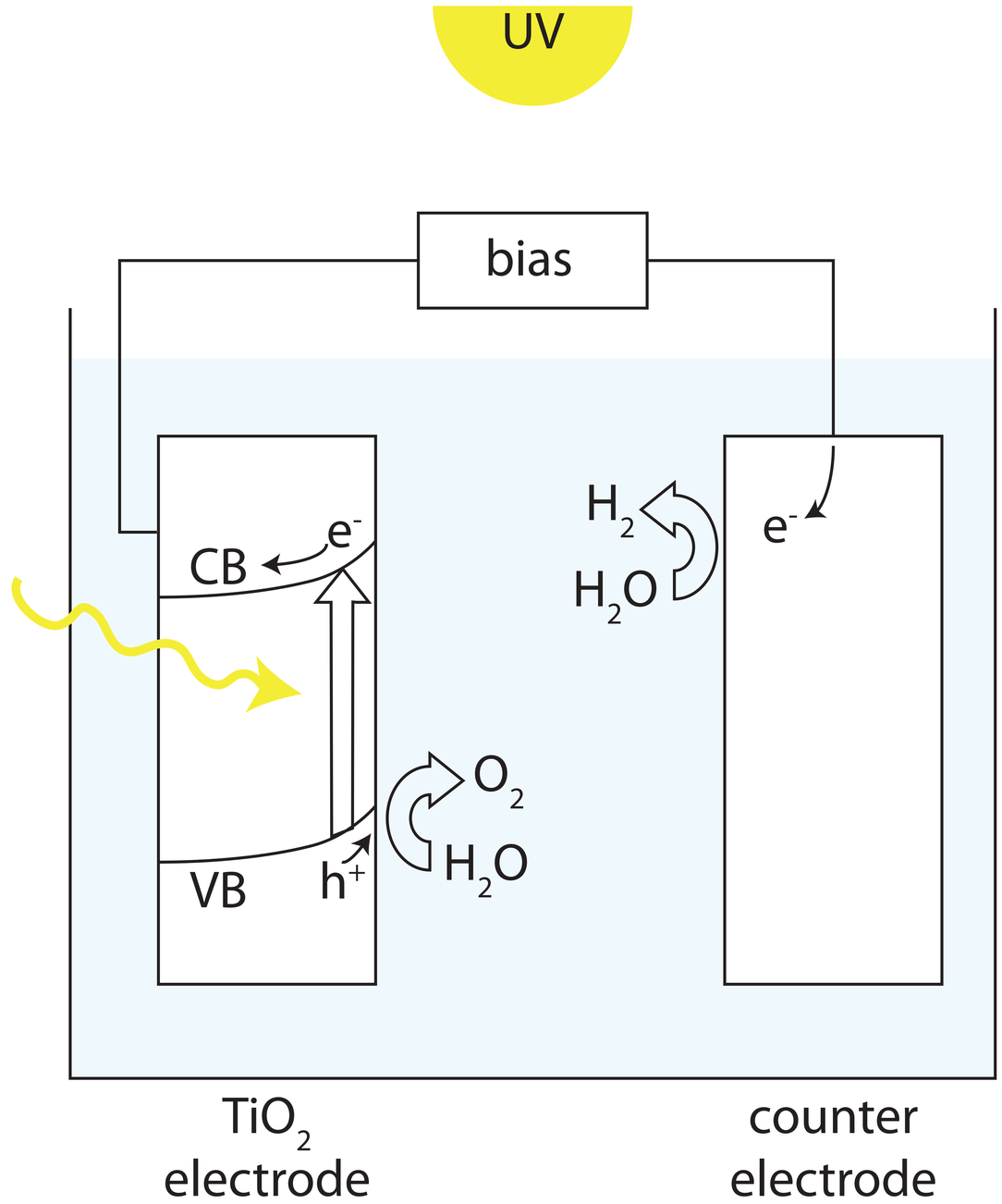

Graetzel, M. Nature

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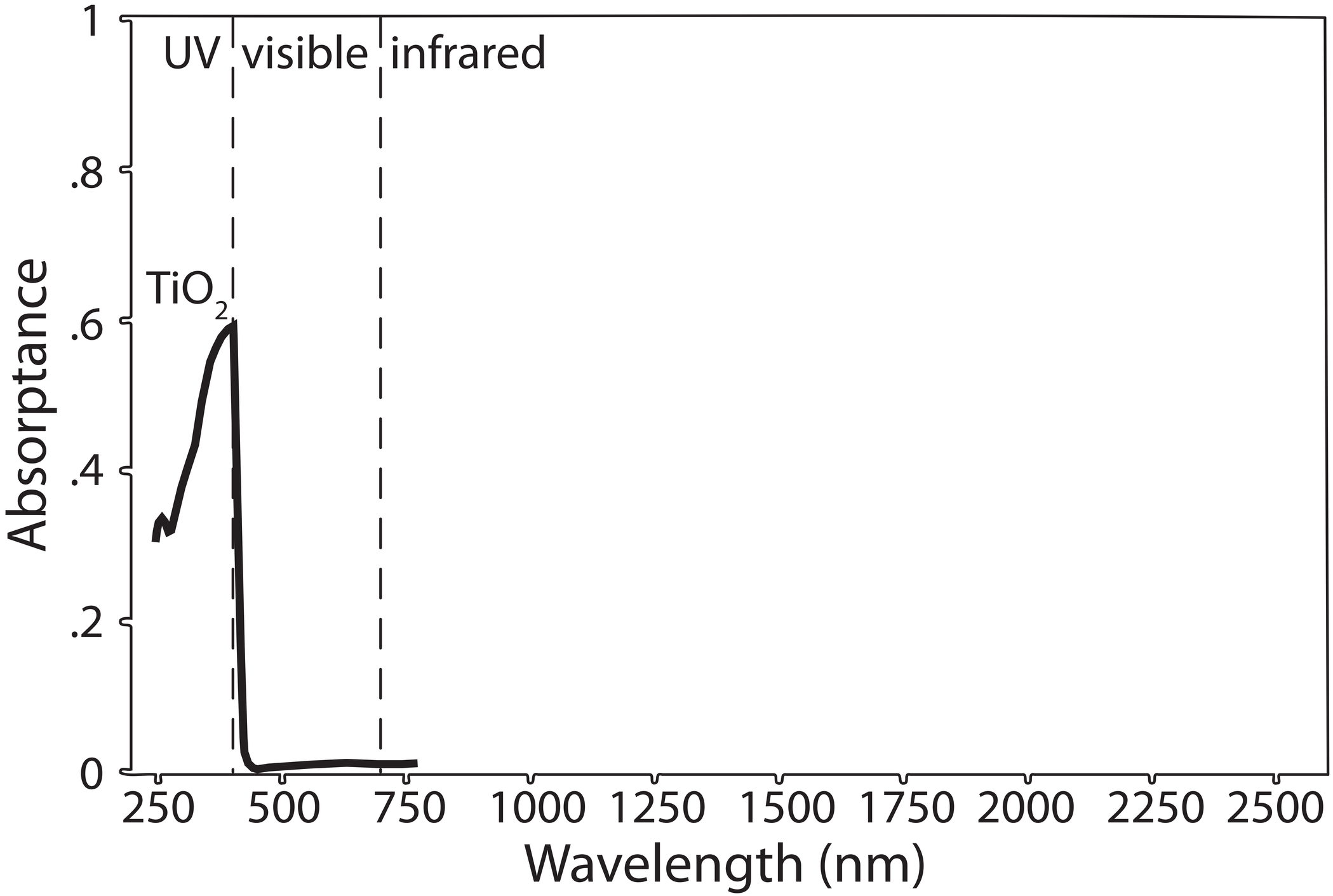

http://bouman.chem.georgetown.edu/S02/lect23/lect23green.html

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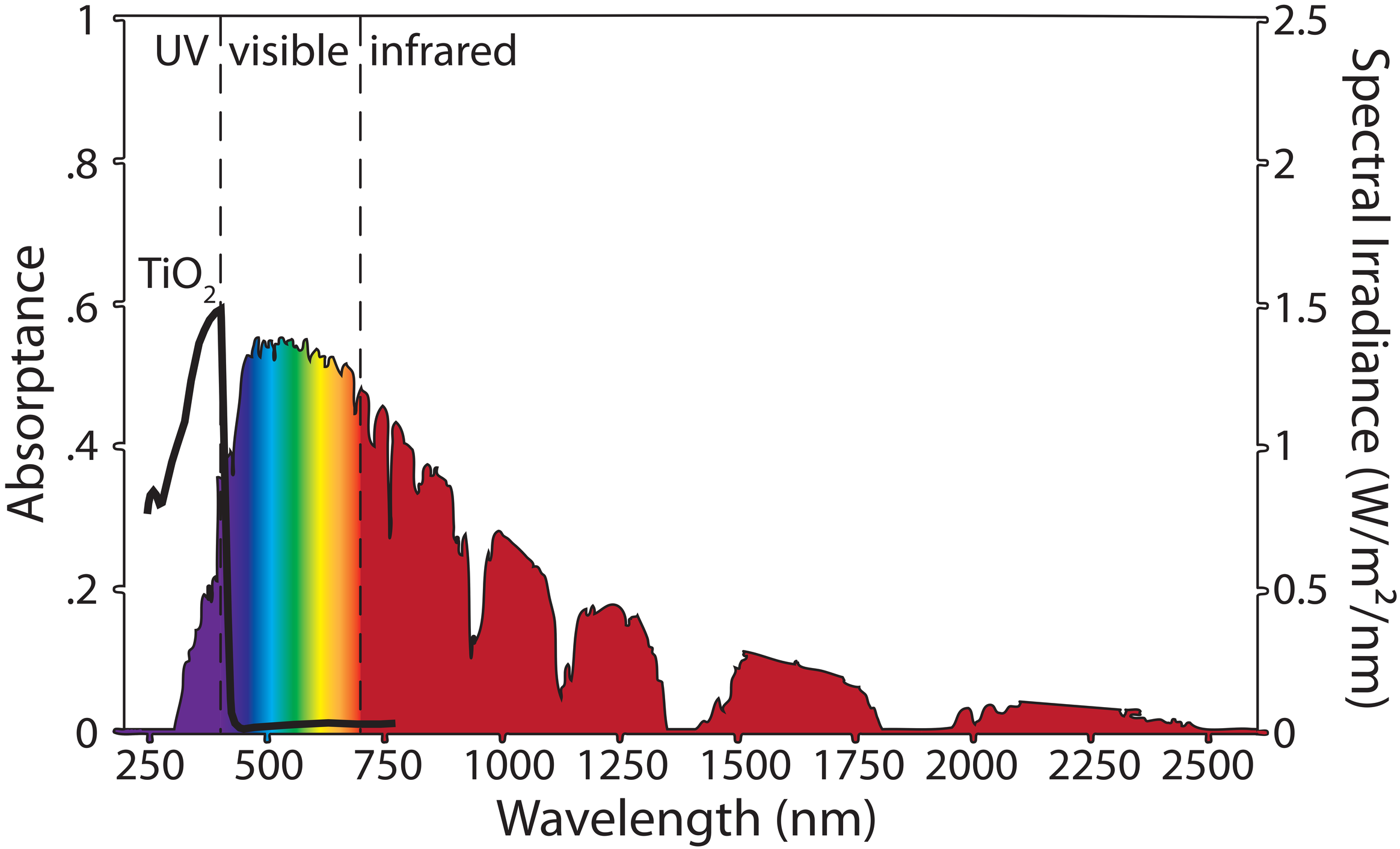


http://bouman.chem.georgetown.edu/S02/lect23/lect23green.html

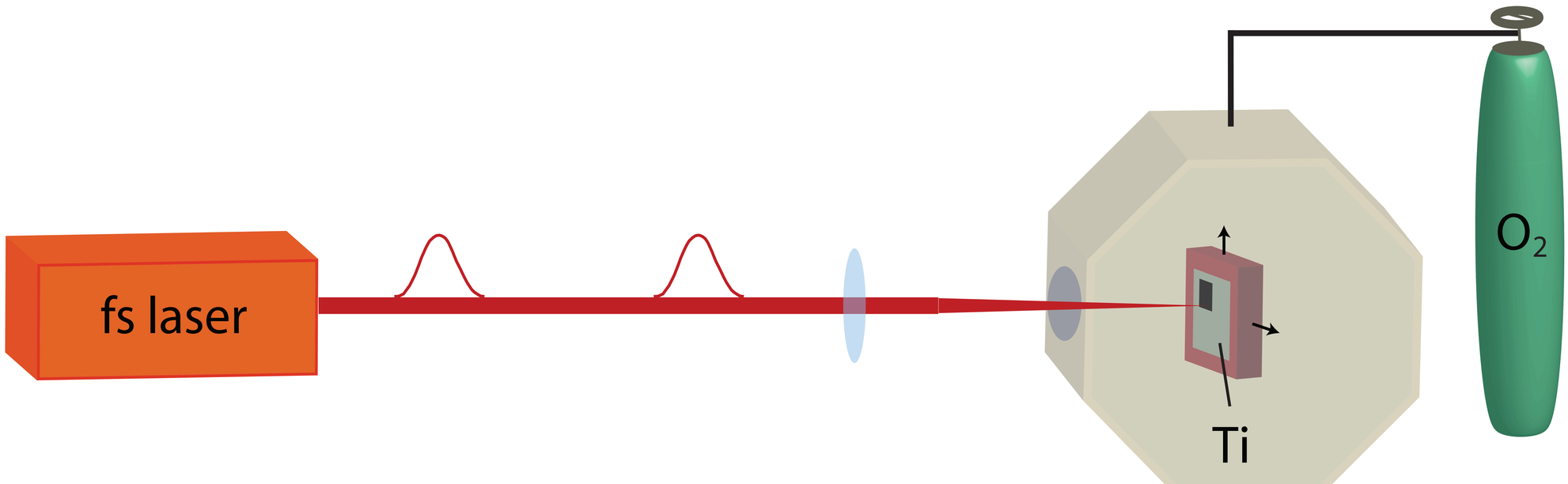
Research Aims

Produce structured TiO_2 surfaces using femtosecond laser processing

Dope TiO_2 with chromium

Improve photocatalysis of water at doped TiO_2 electrodes

Laser fabricated TiO_2



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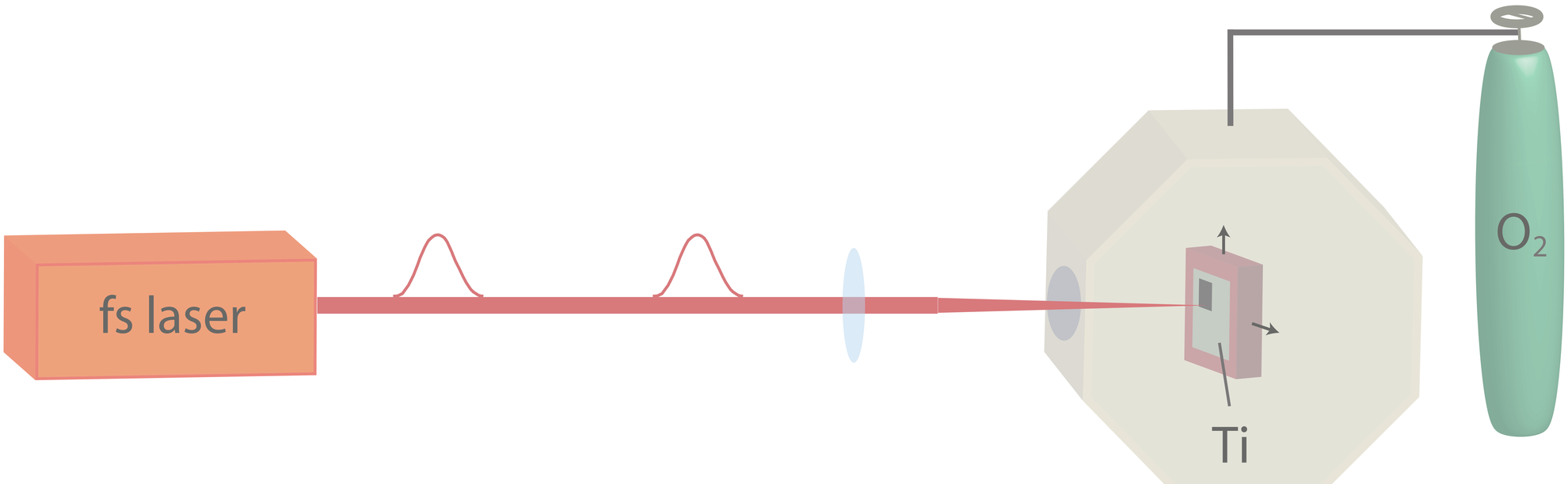
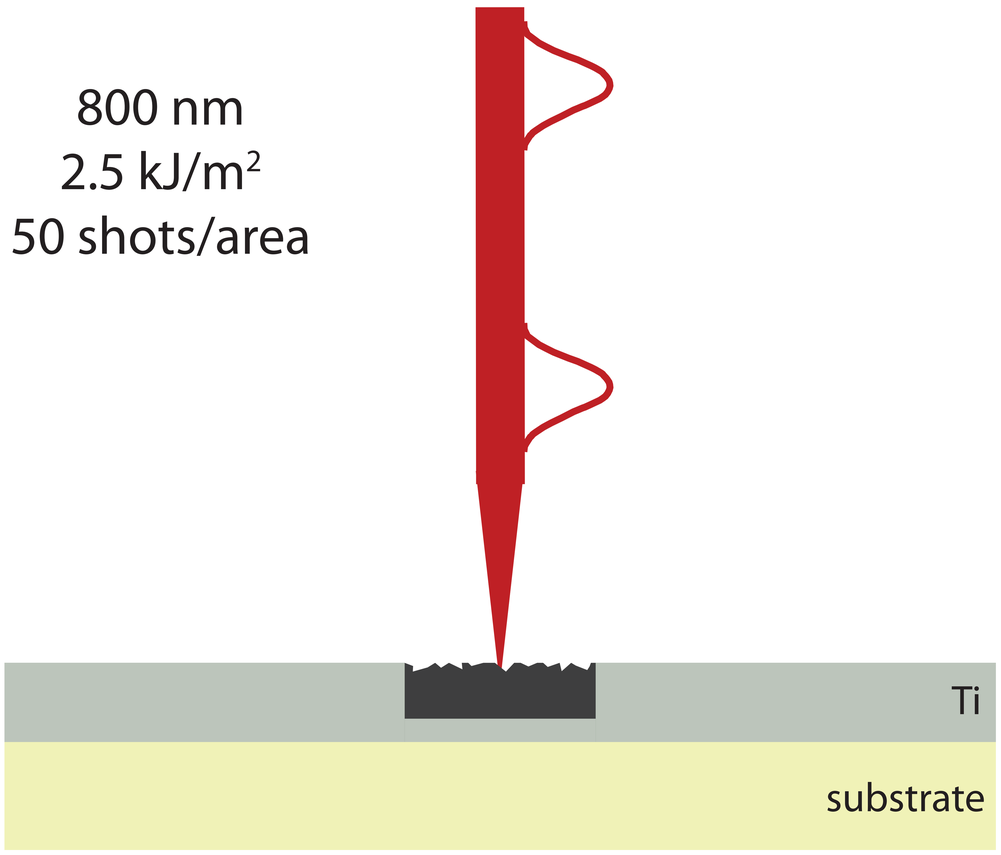
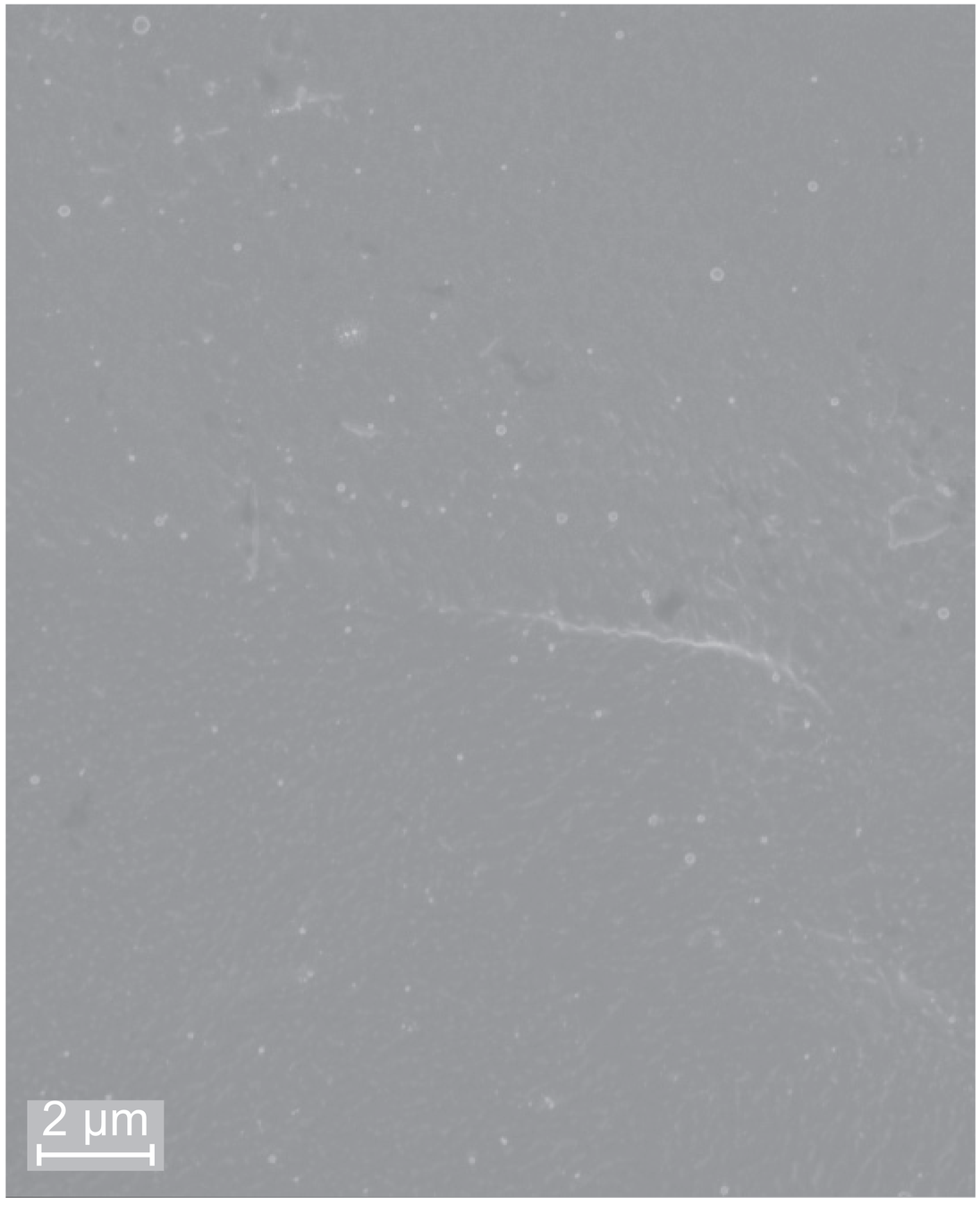


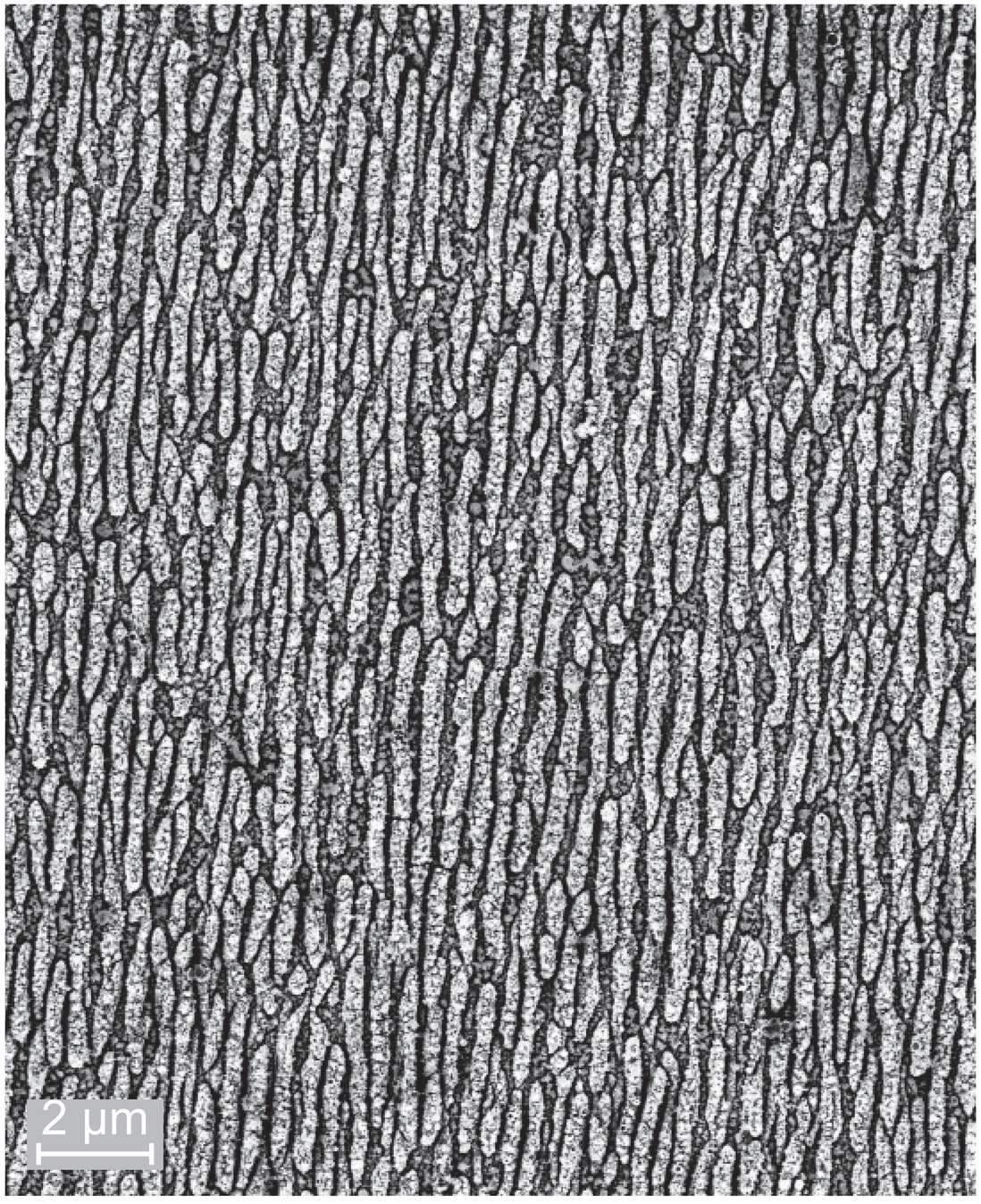


Laser fabricated TiO_2

microstructures



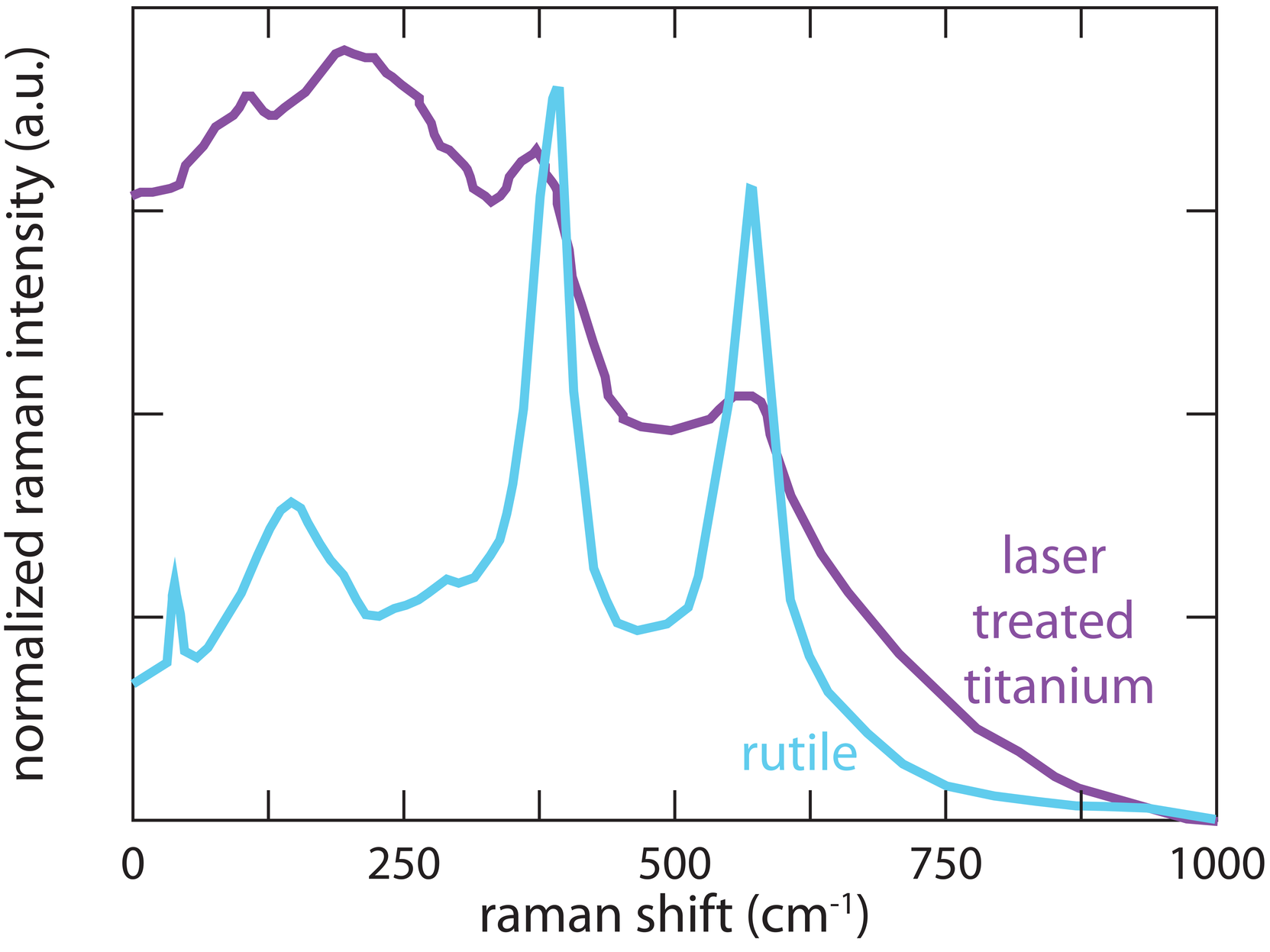
bare titanium



laser treated titanium

Laser fabricated TiO_2

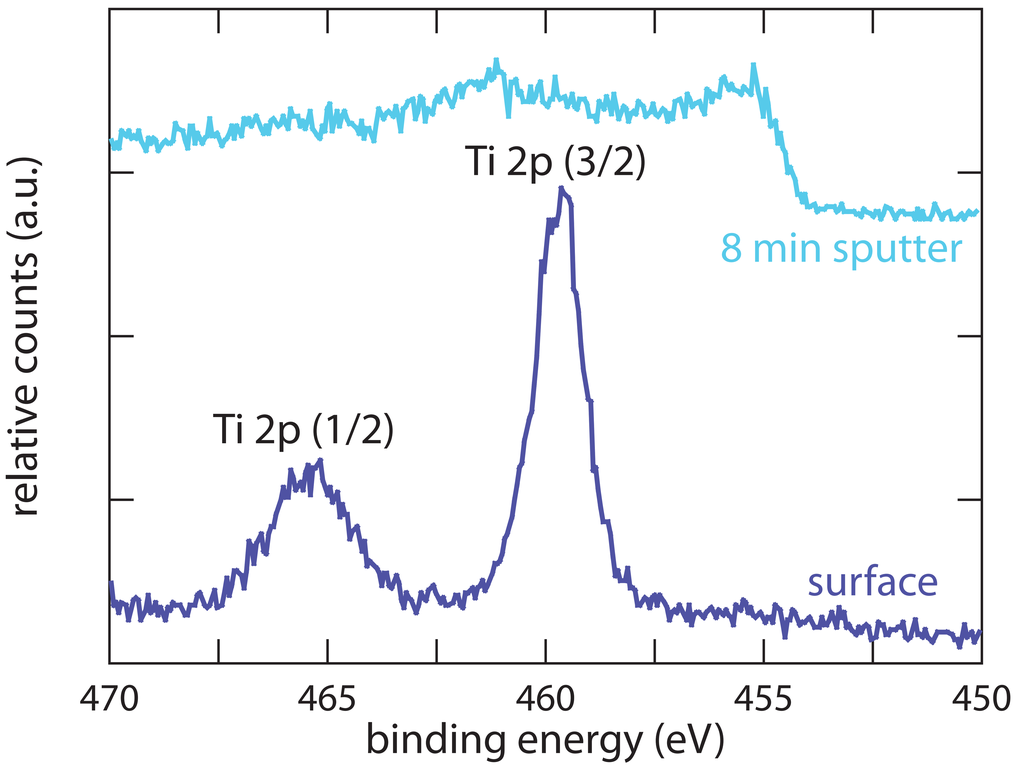
structural data: raman spectroscopy



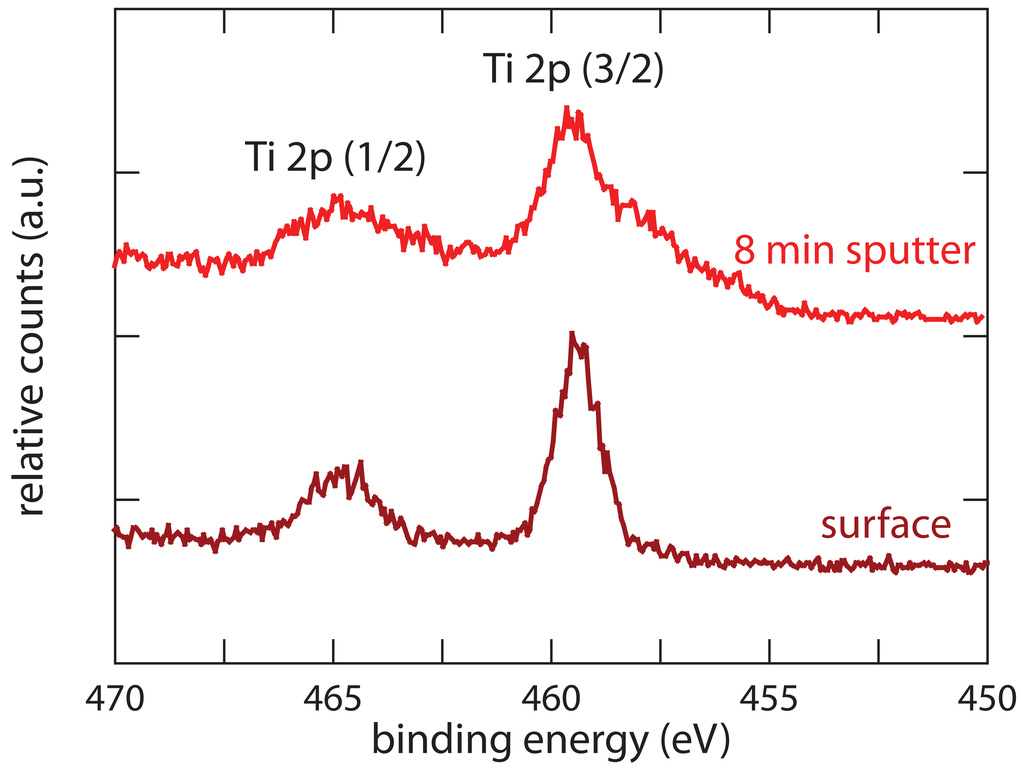
Laser fabricated TiO_2

structural data: XPS

bare titanium plate



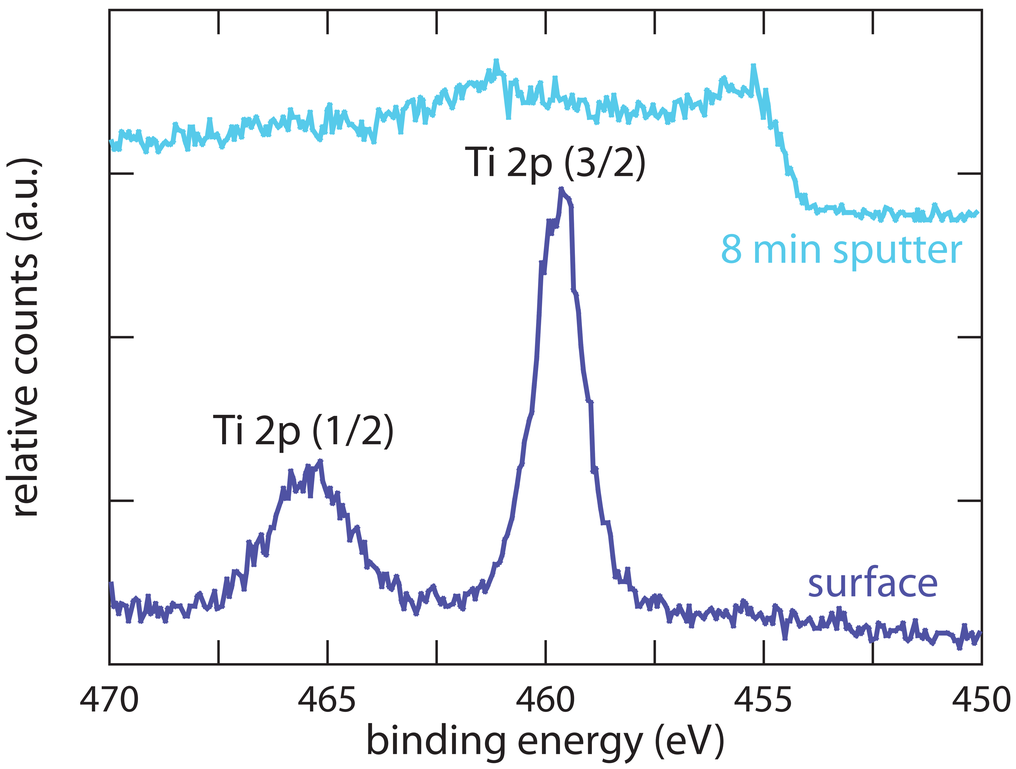
laser treated titanium



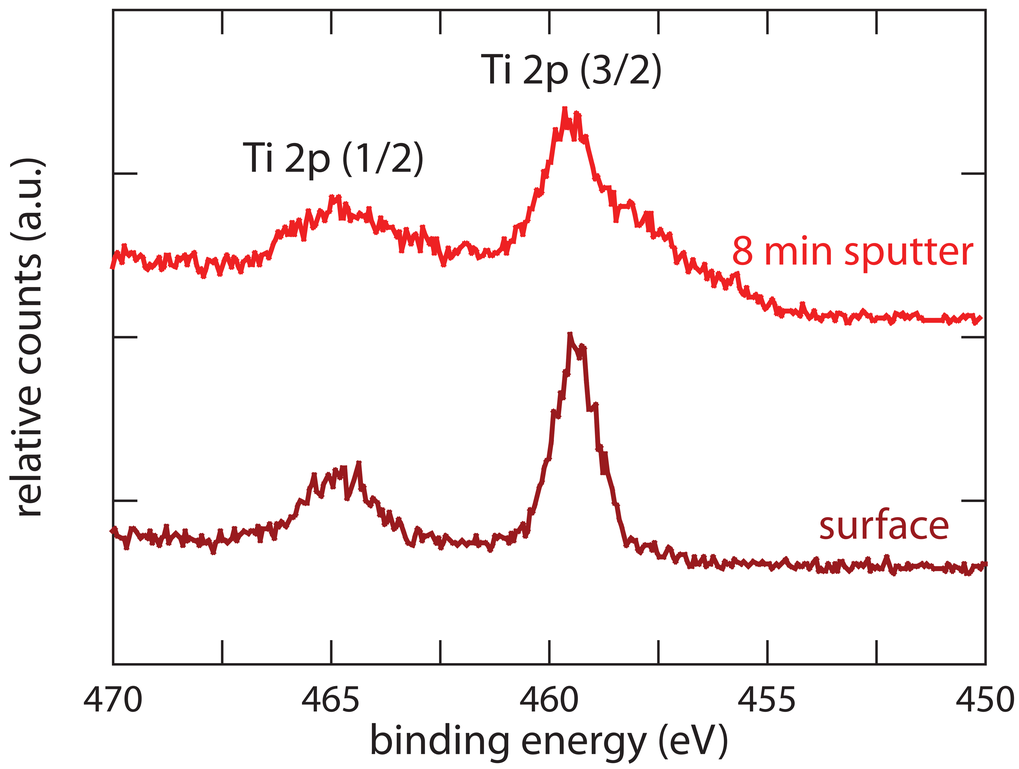
Laser fabricated TiO_2

structural data: XPS

bare titanium plate



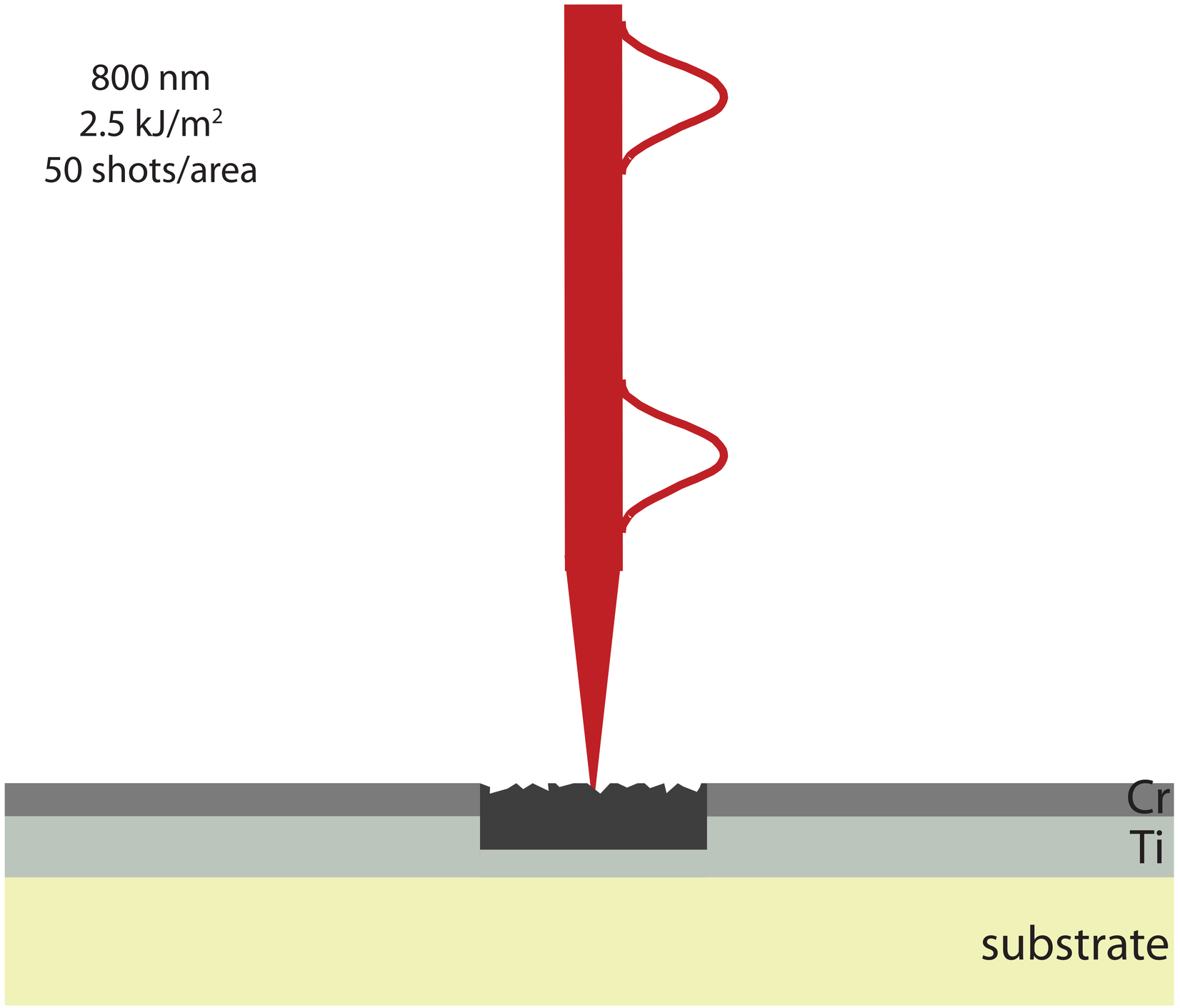
laser treated titanium



We have produced TiO_2 with laser processing

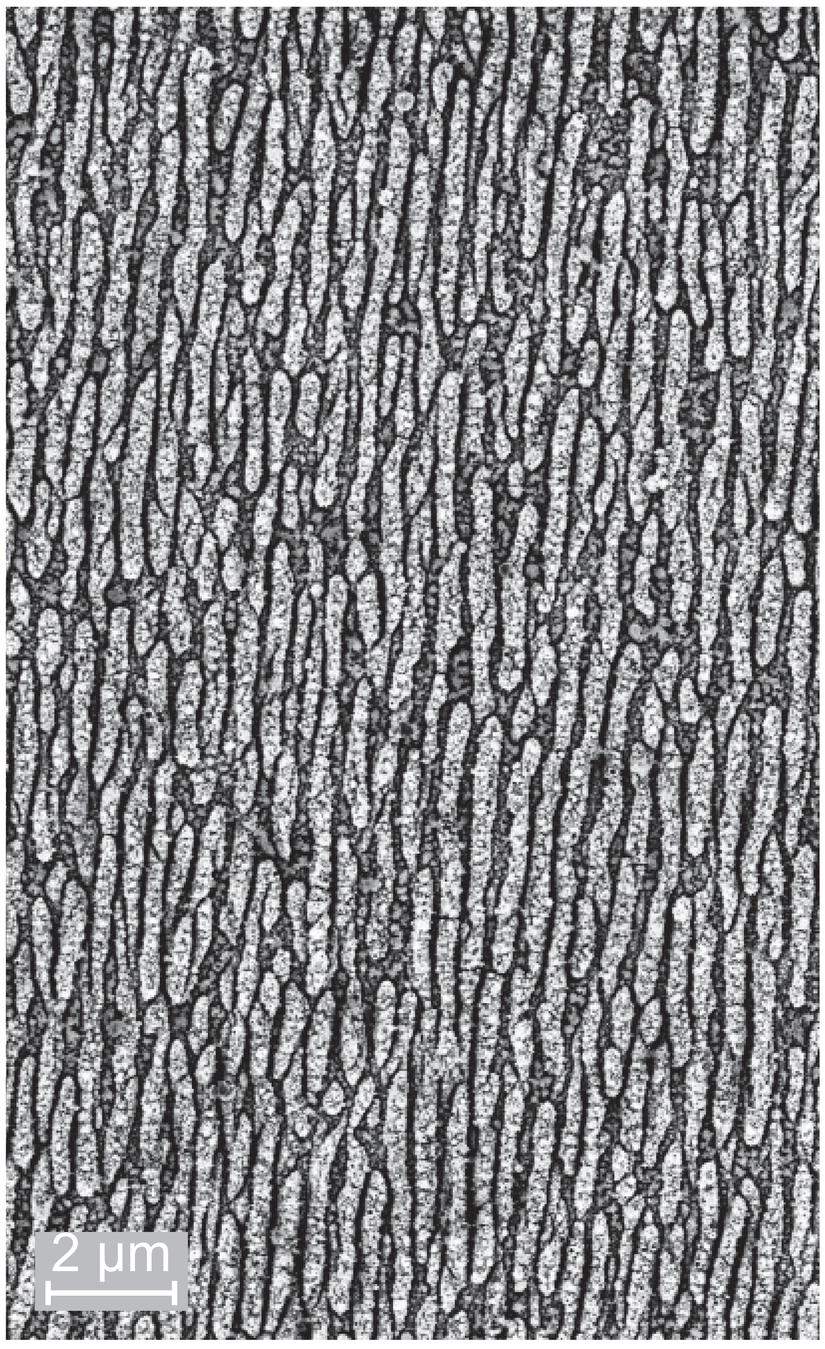
Laser fabricated doped TiO_2

800 nm
2.5 kJ/m^2
50 shots/area

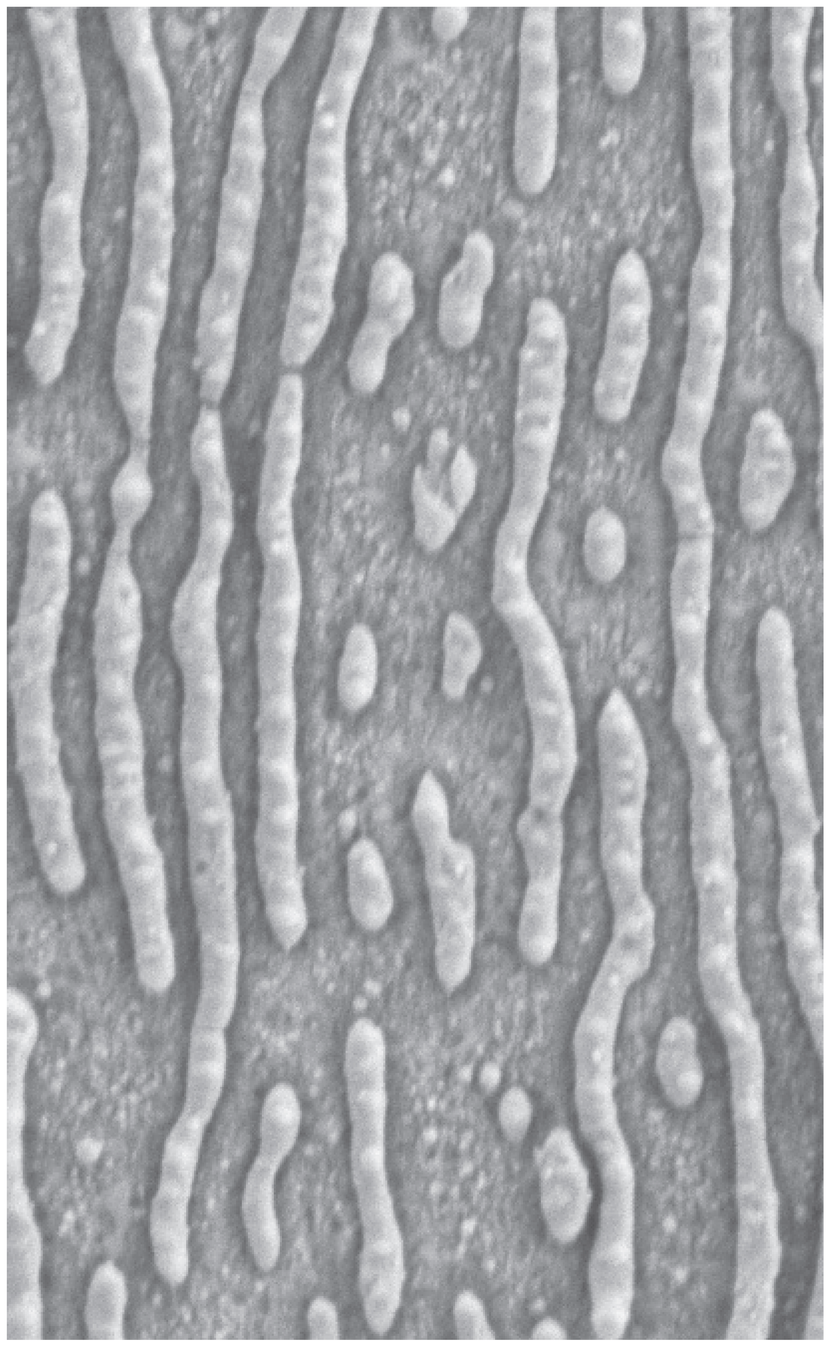


Laser fabricated doped TiO_2

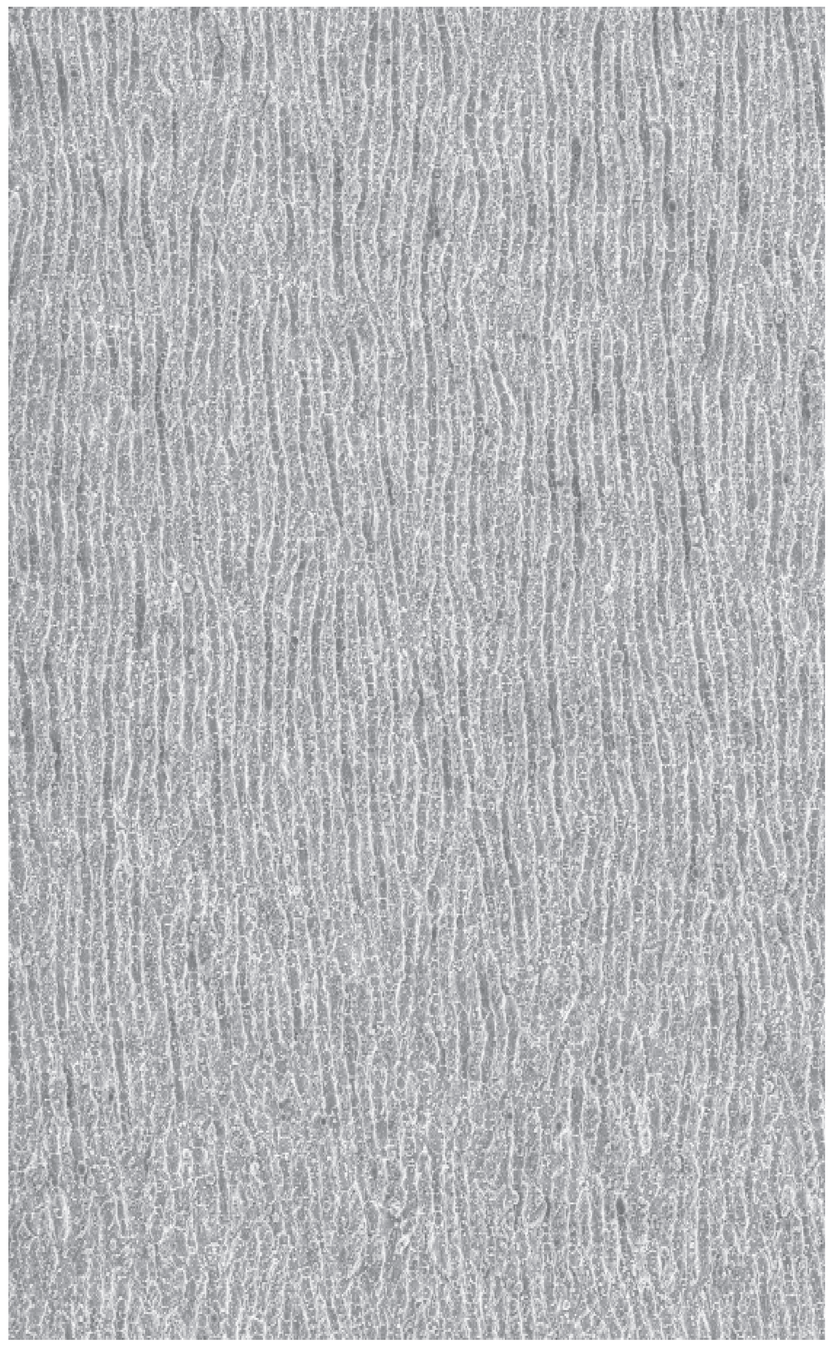
microstructures



0 nm Cr
no doping



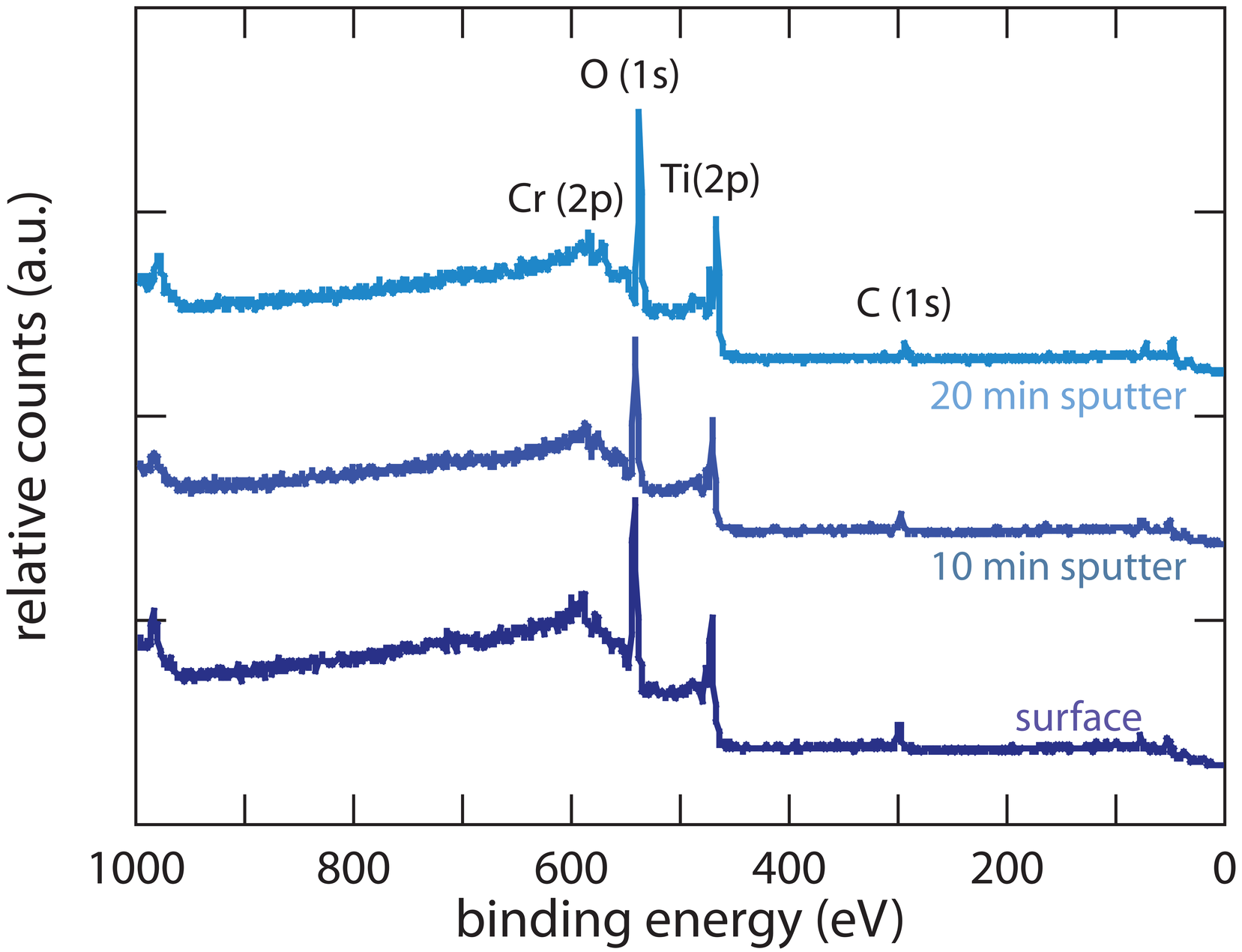
10 nm Cr
7% Cr-doped



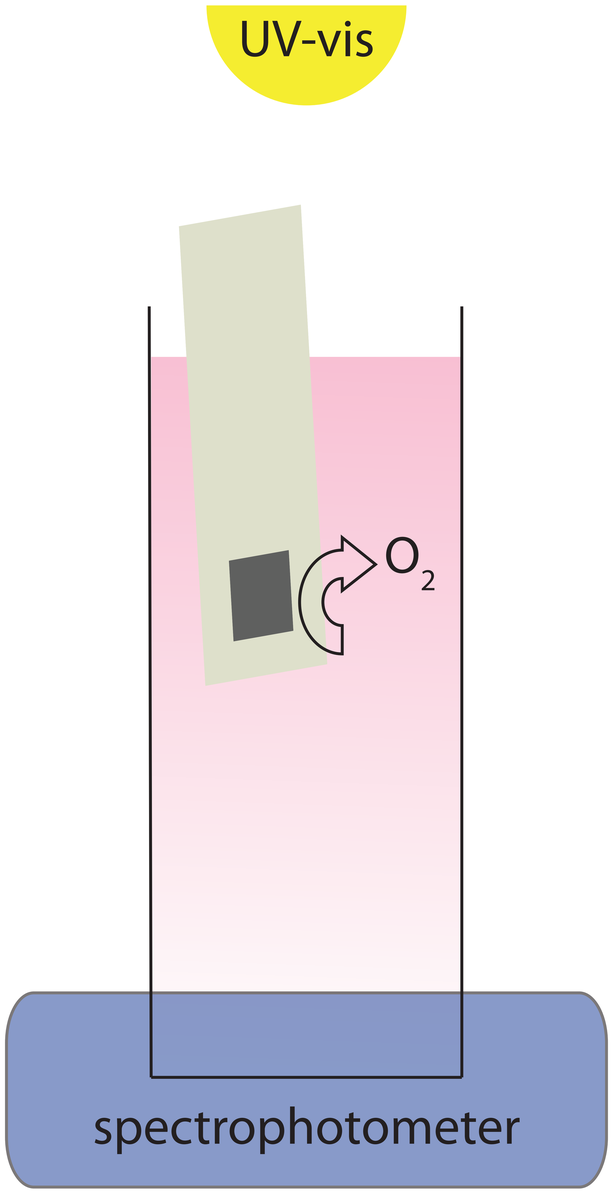
70 nm Cr
30% Cr-alloy

Laser fabricated doped TiO_2

structural data: XPS



Photocatalysis



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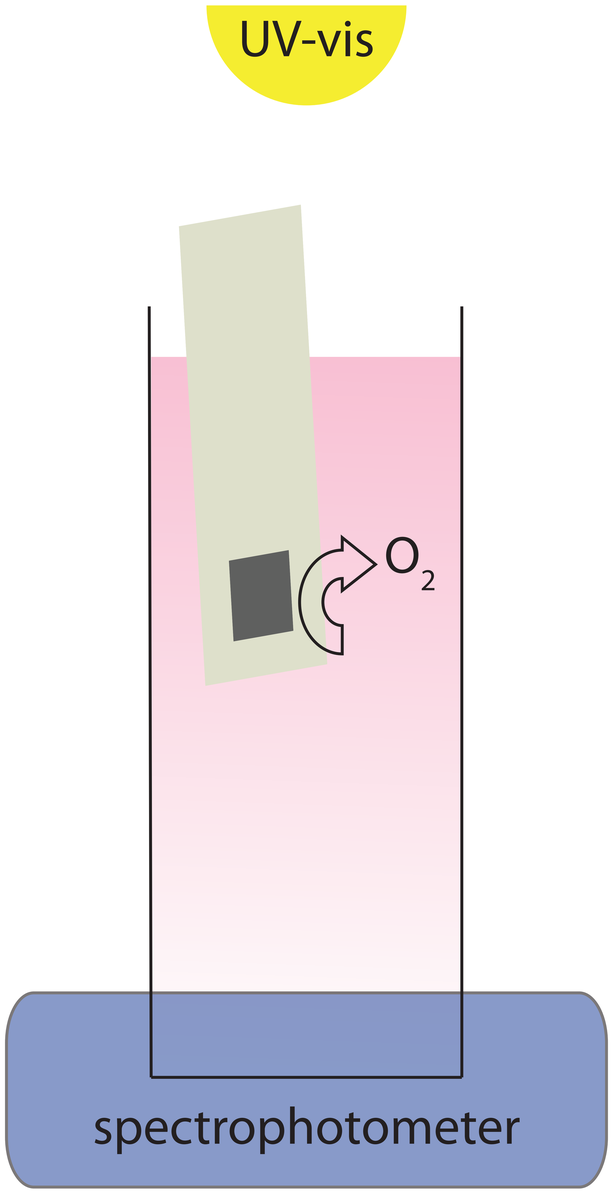

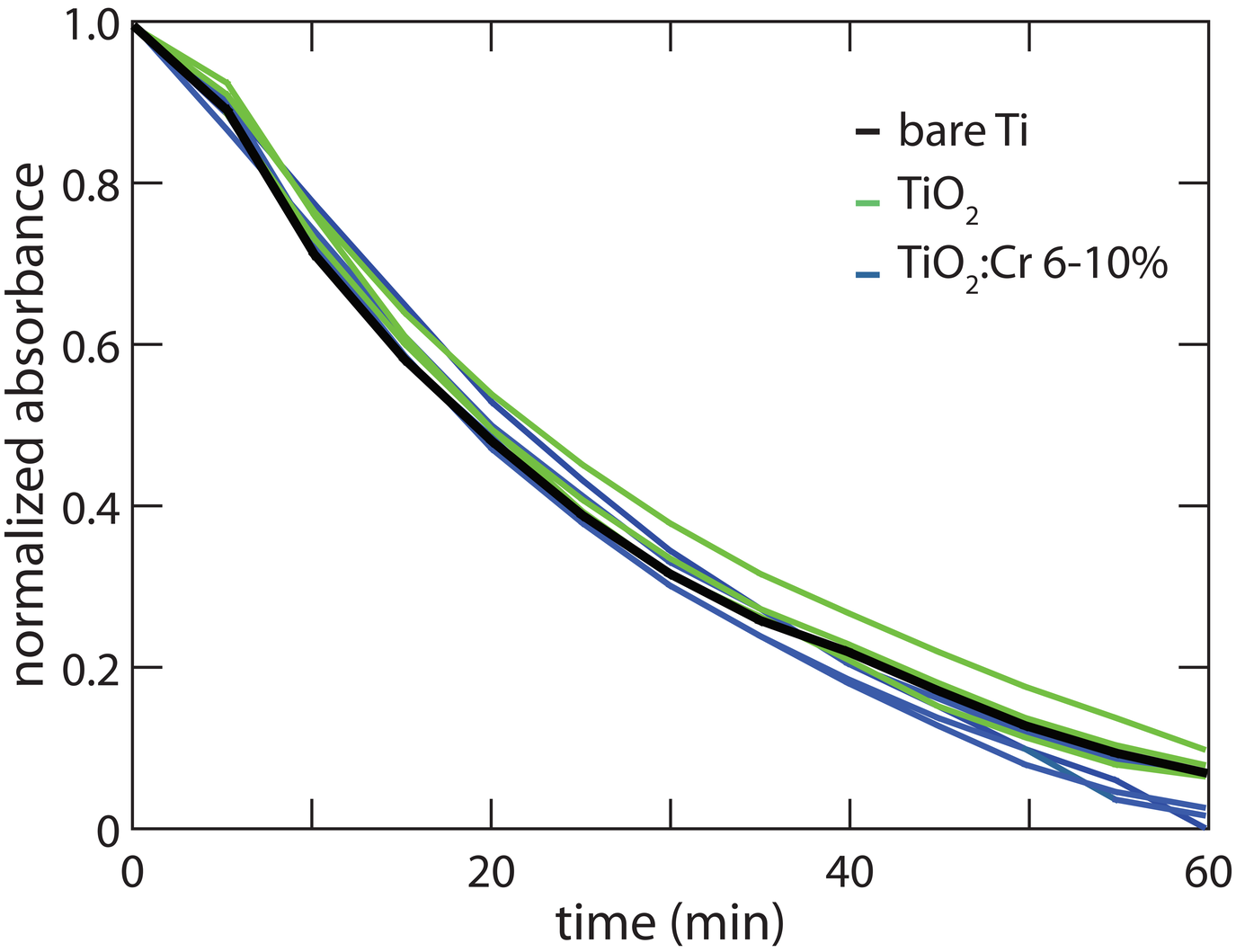

Summary

Form TiO_2 with laser processing

Control Cr-doping by amount of chromium layer deposited

Improvements on doping should increase photocatalysis for laser doped TiO_2

I												III	IV	V	VI	VII	VIII
H	II																He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe

Thank you!

HARVARD
School of Engineering
and Applied Sciences

MAZUR GROUP

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and Harvard Center for the Environment

1 µm