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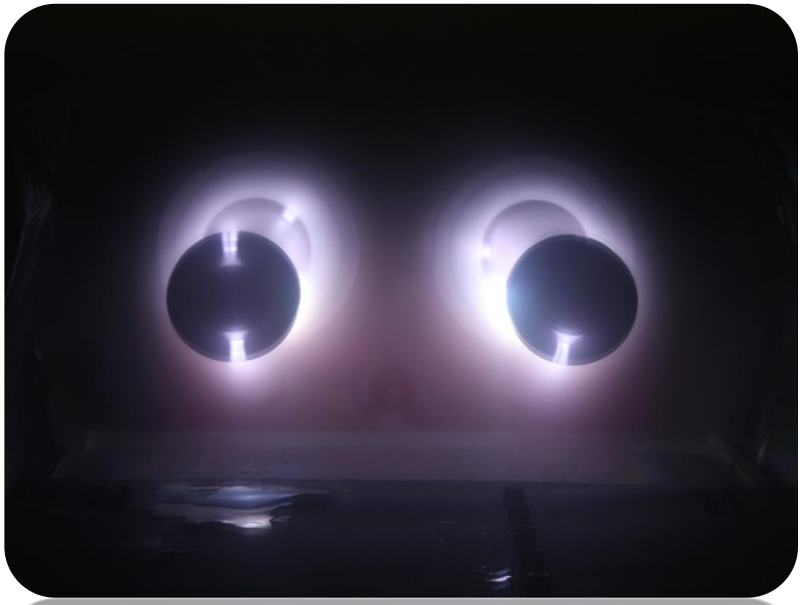
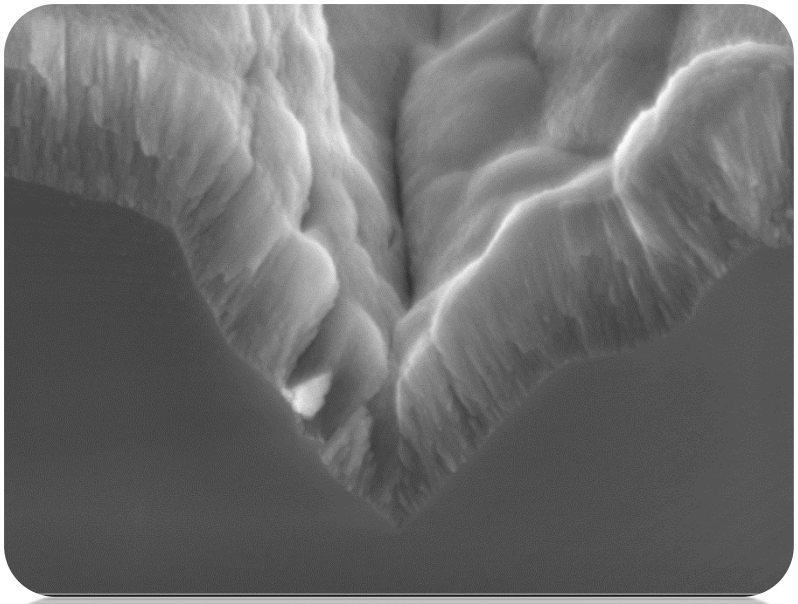
Innovative approach to thin film sensor development





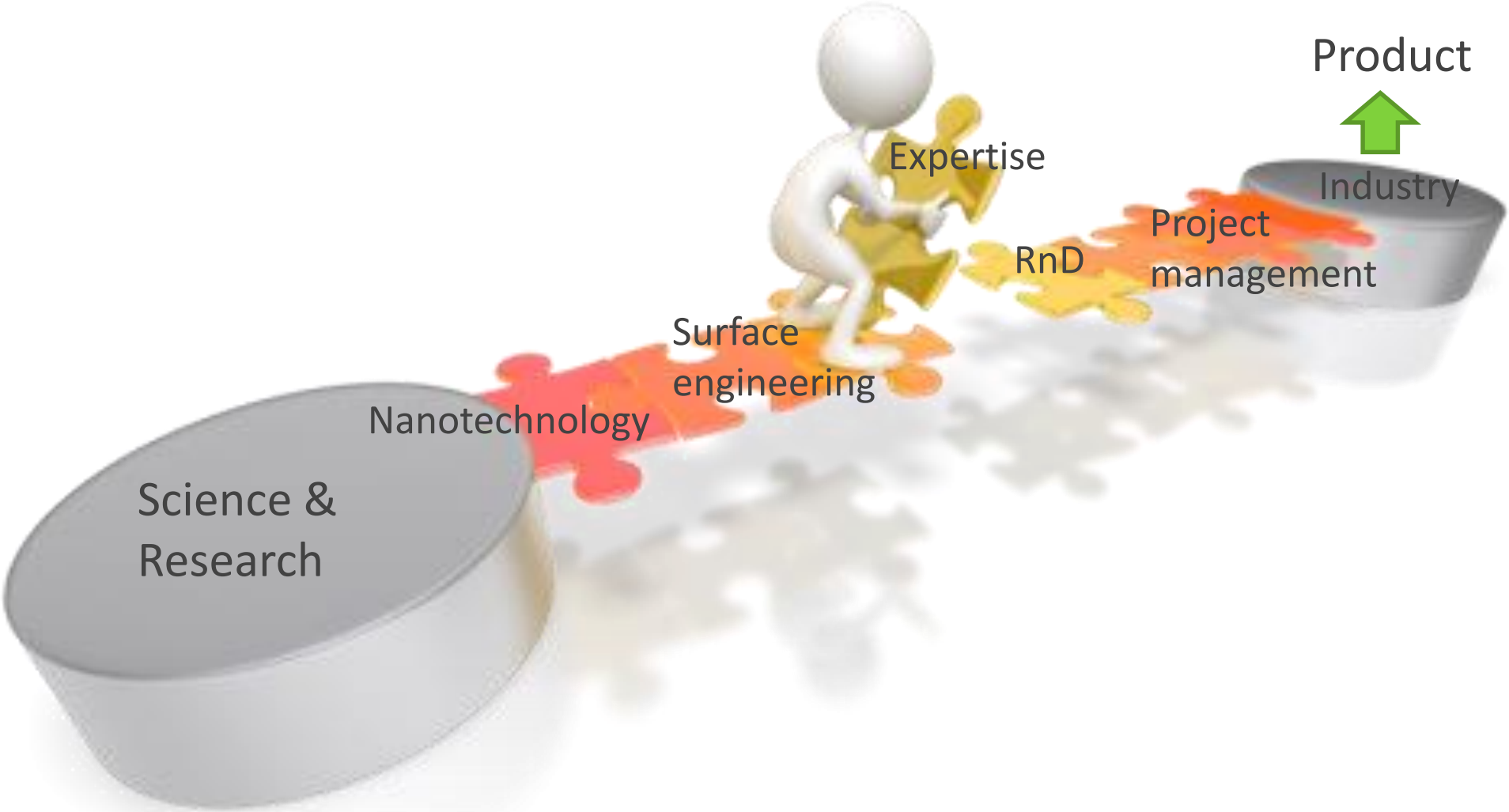
Ambiörn Wennberg

Dr. Iván Fernández Martínez

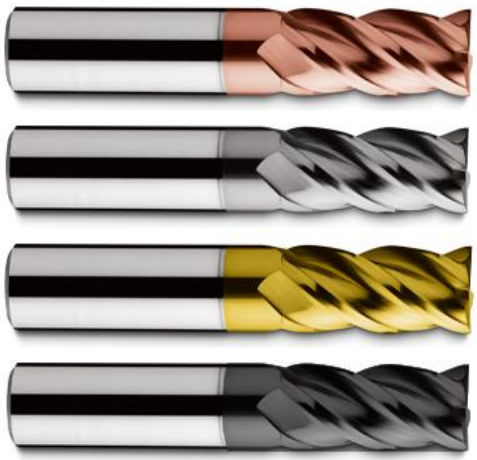
www.nano4ENERGY.eu

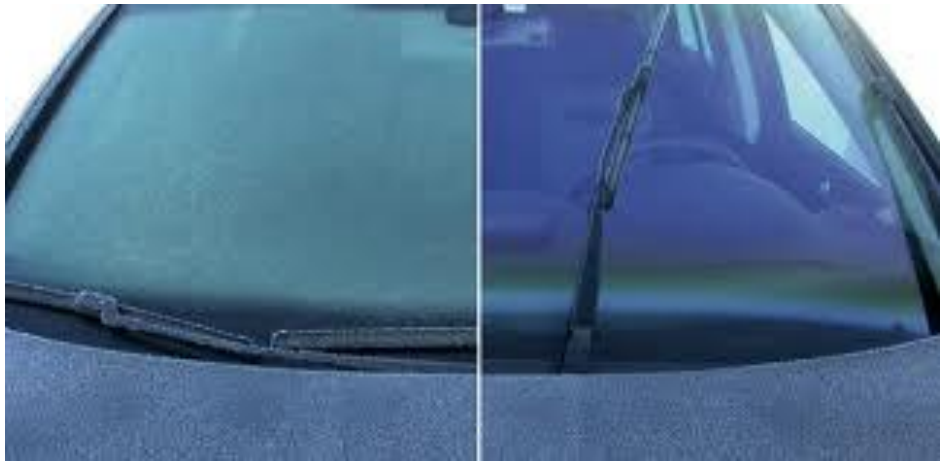
NanoSD 2014, 24/9 2014

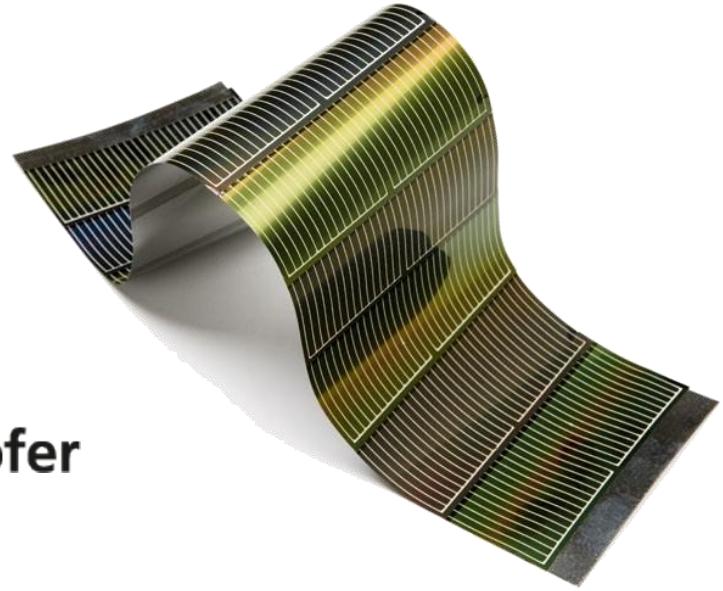
Nanotechnology for the industry



Sputtering







Images Courtesy of:

ionbond

Fraunhofer

NREL

SAMSUNG

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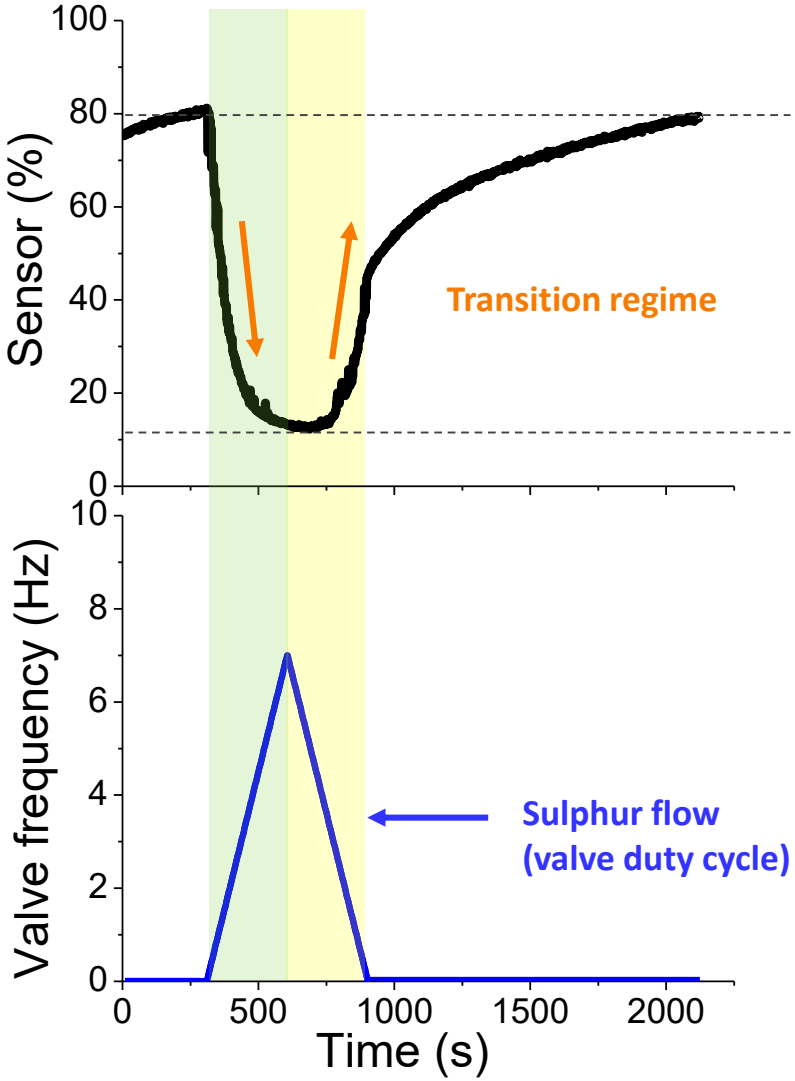
Where is the “innovative approach”?

Inventing new materials

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo
		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	
		89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

Hysteresis ramps: P.E.M.



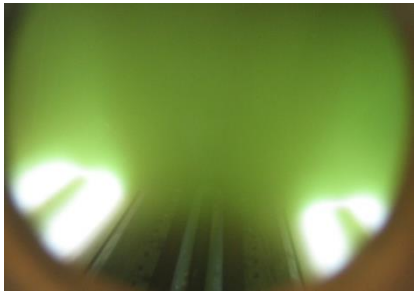
'Metal'

λ Sensor (CCD)= **510.8nm (Cu)**

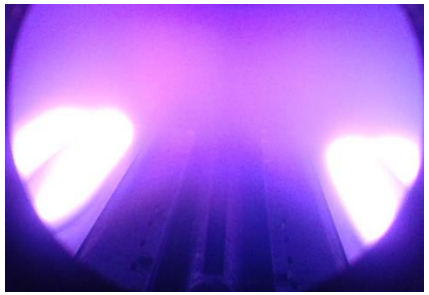
Fully poisoned

Plasma emission spectrums for In, Cu & Zn in the presence of Sulphur

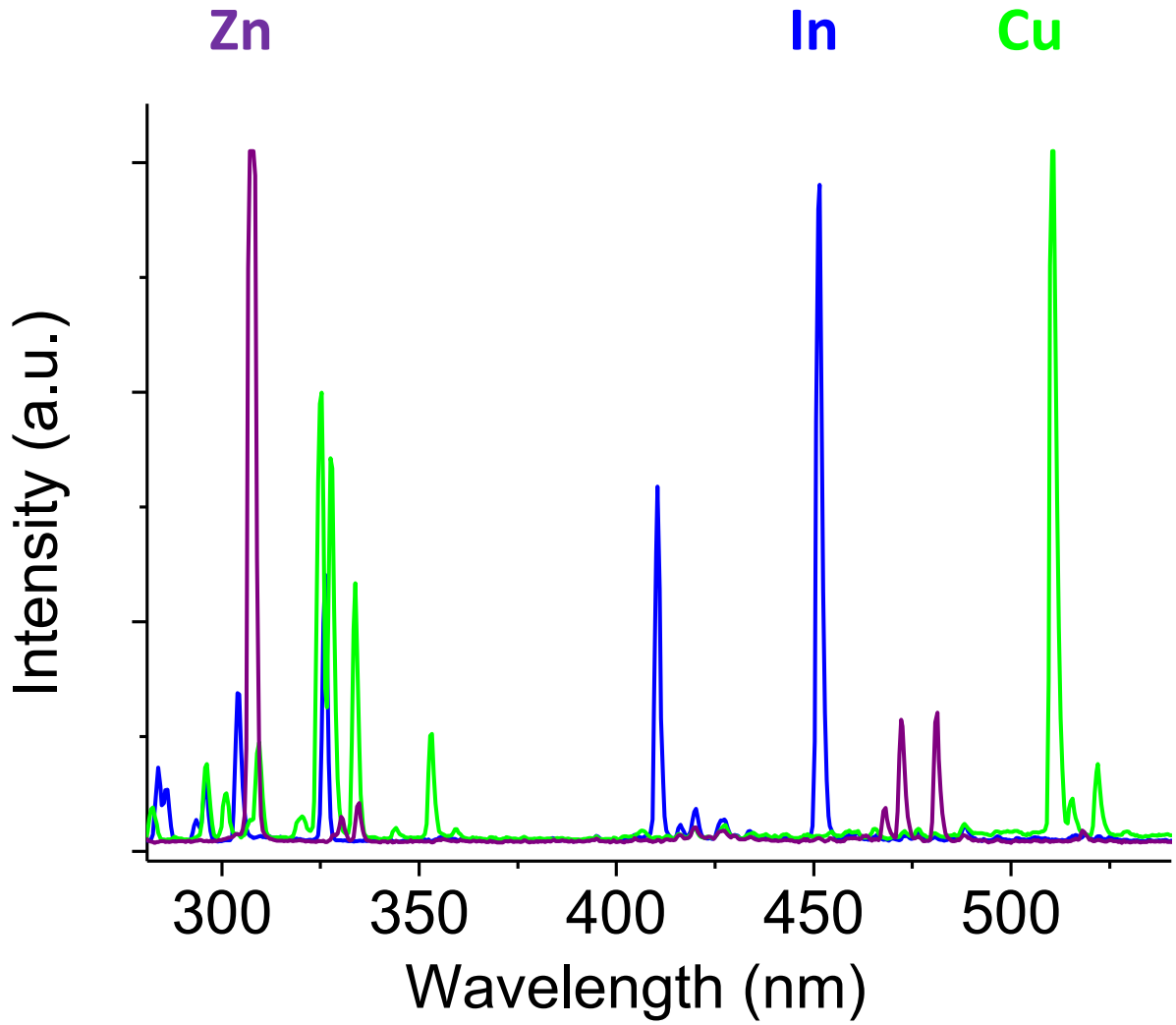
In



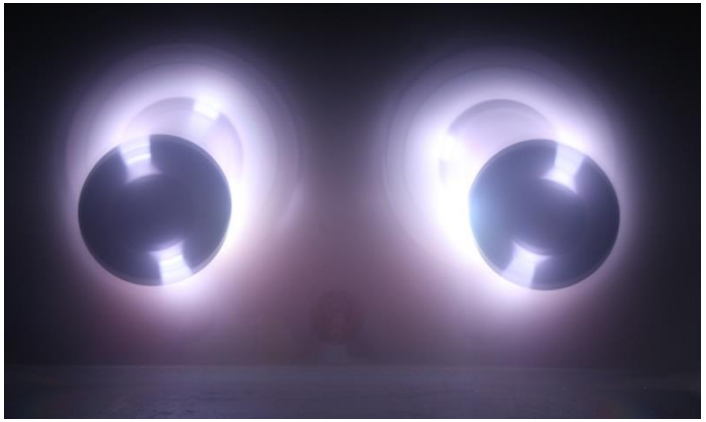
Cu



Zn



The PulseFlo™ Technology

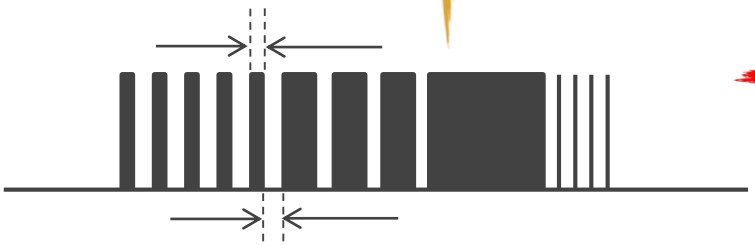


Power

Actuator

Sensor

Flow

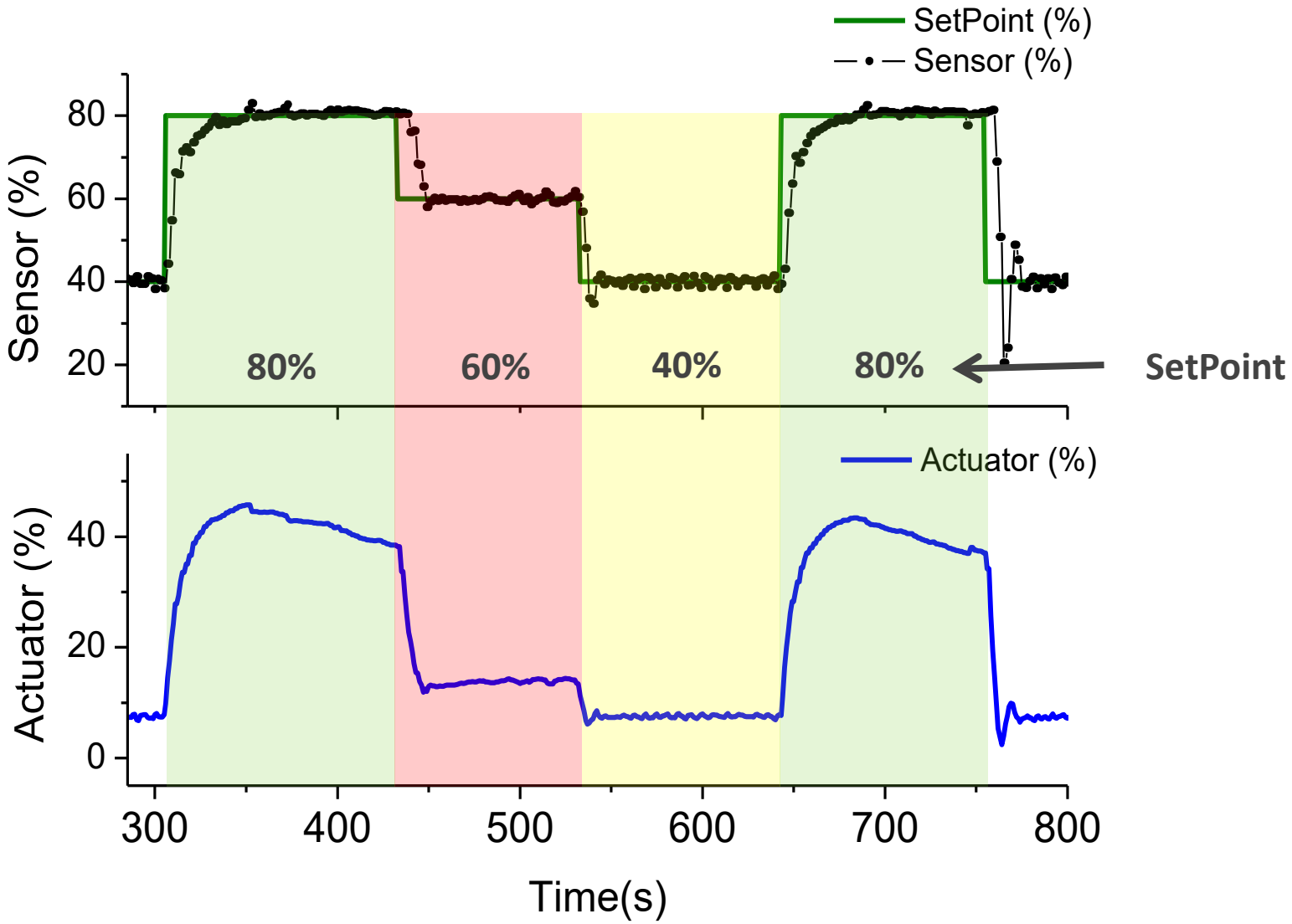


Actuator

GENCOA

PulseFlo™ controlled effusion cell

Example of Selenium flow adjustments via feedback control

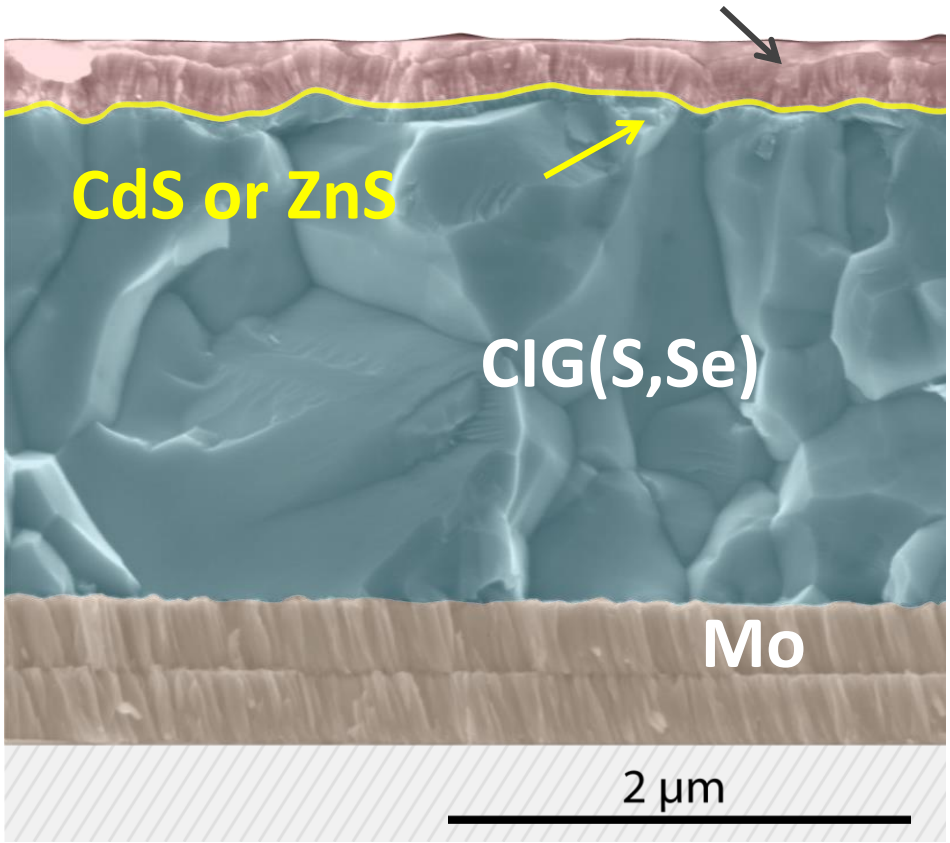


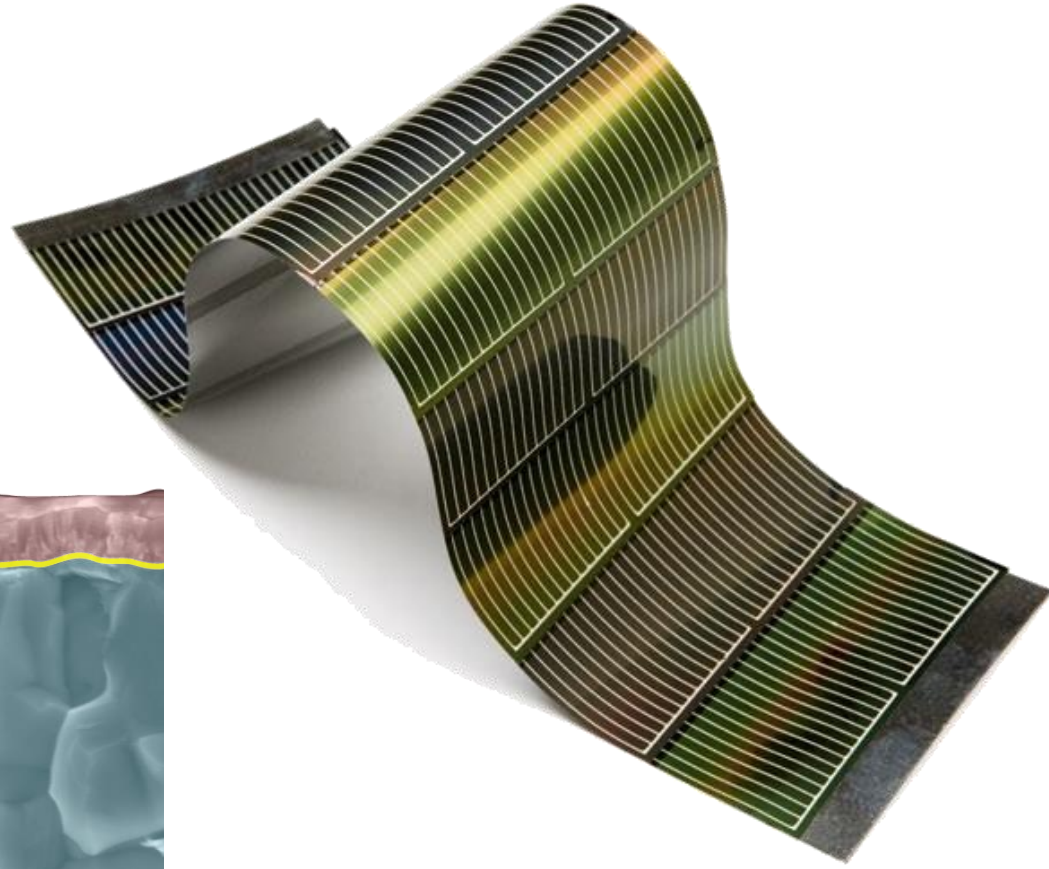
The PulseFlo™ Technology

nano4ENERGY

Invention patented by
Nano4Energy SL and Gencoa Ltd

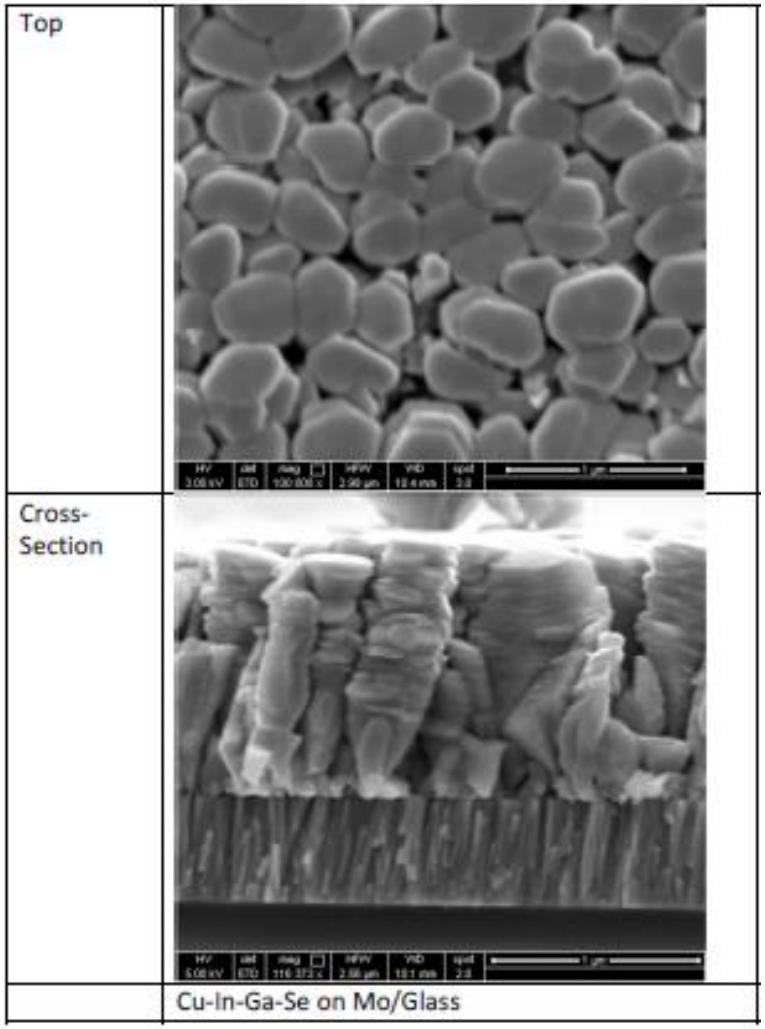
CIGS/CZTS

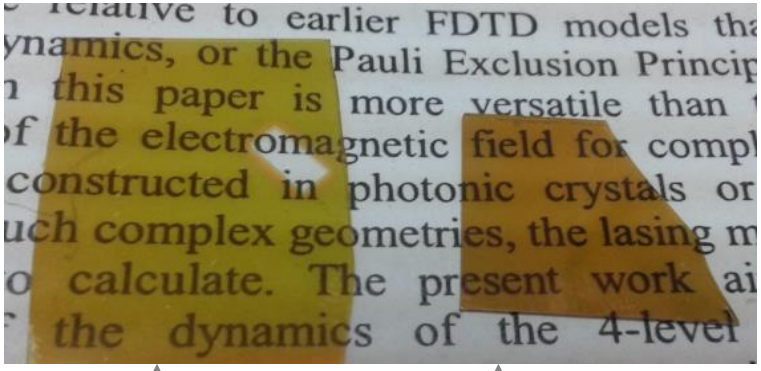




Courtesy of NREL

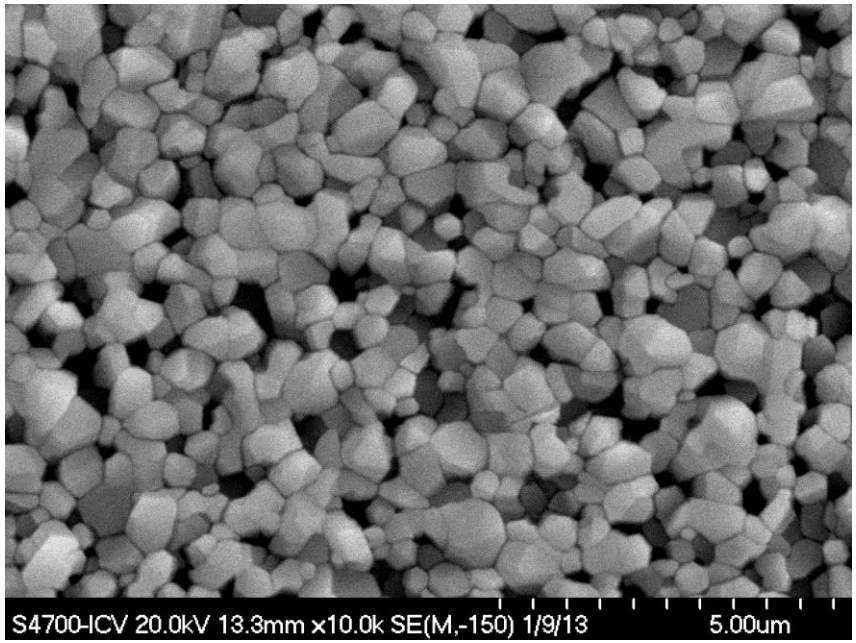
Example of reactively sputtered $CuInGaSe_2$ structure

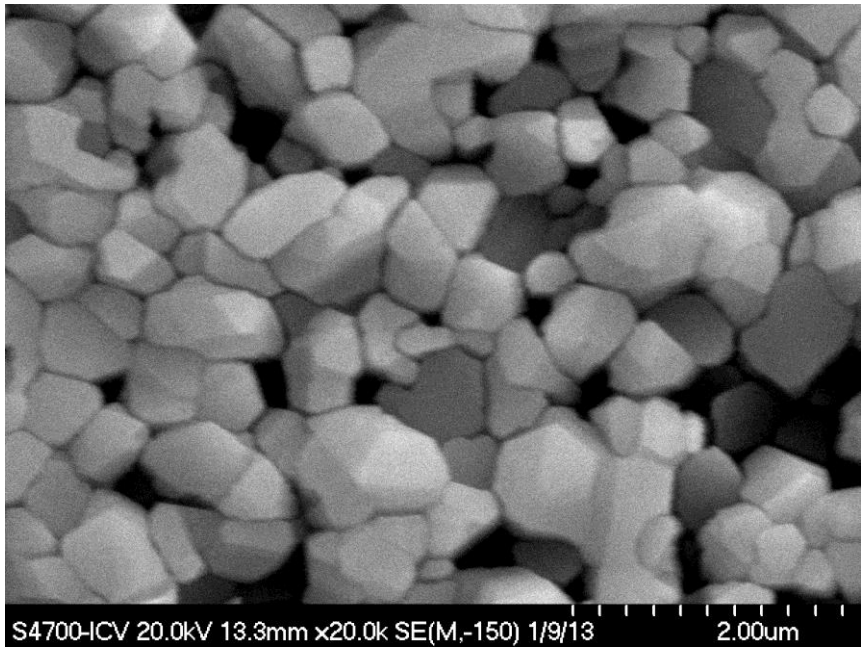




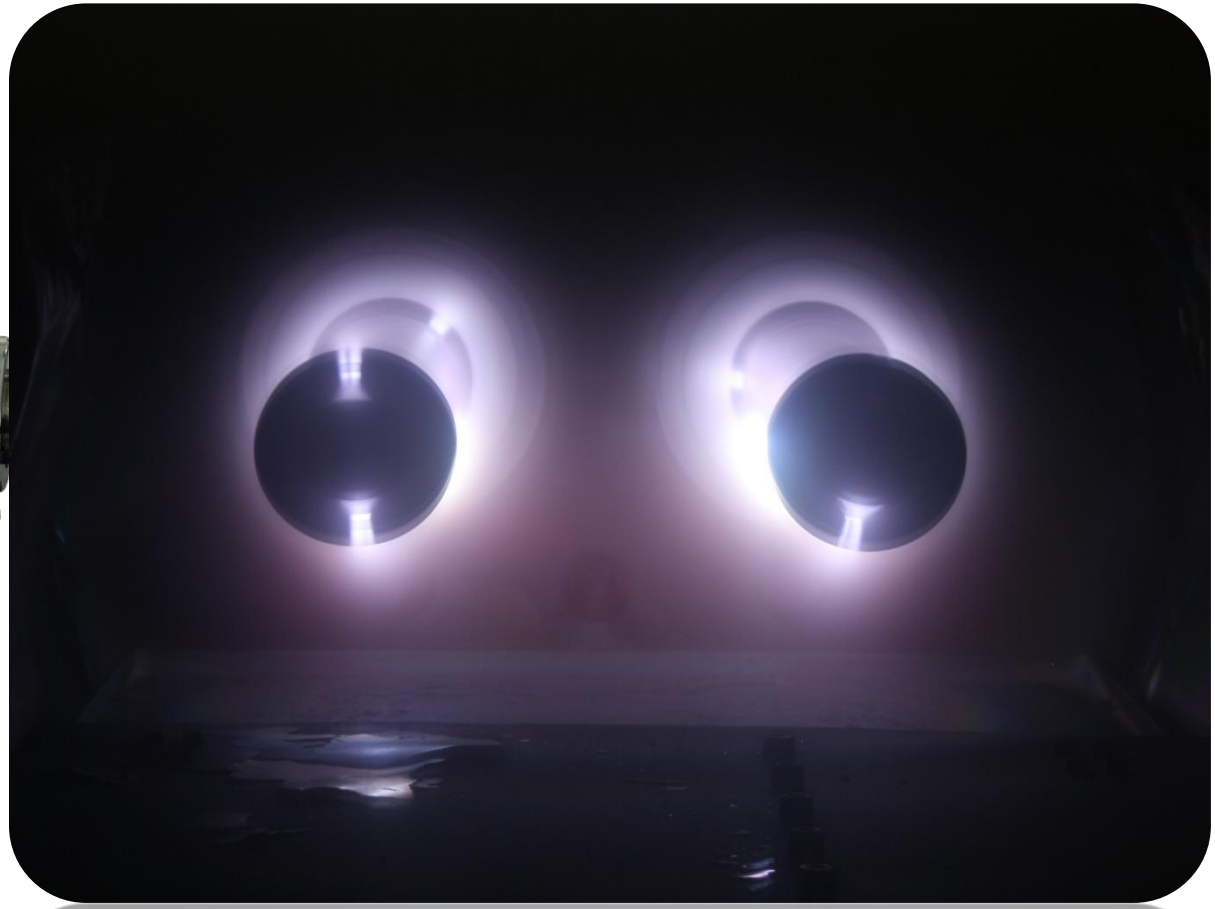
In_2S_3 In_2S_3:V

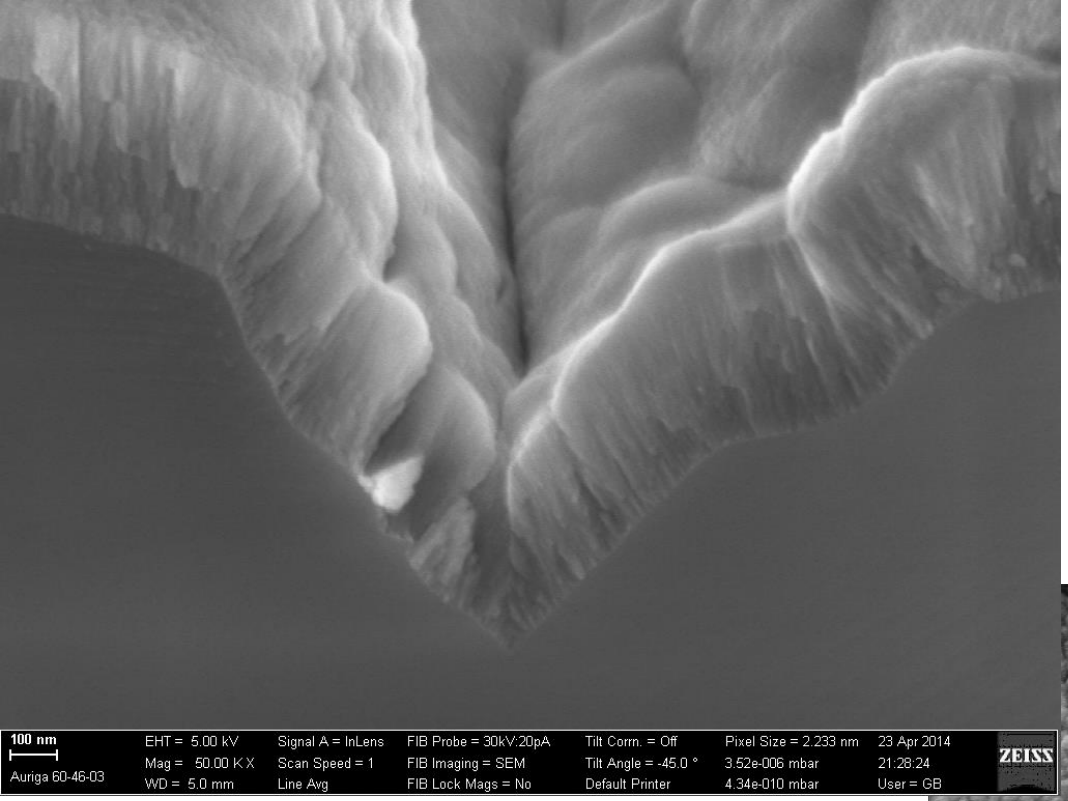
Cu_2Se for thermoelectrics





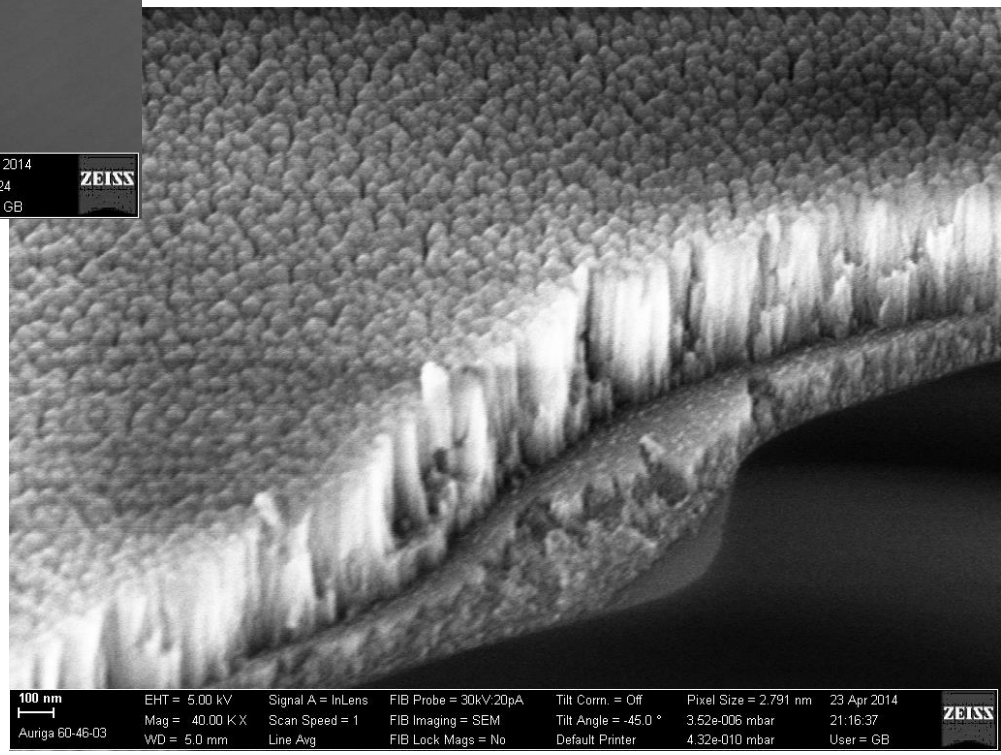
The PulseFlo™ Technology for organics





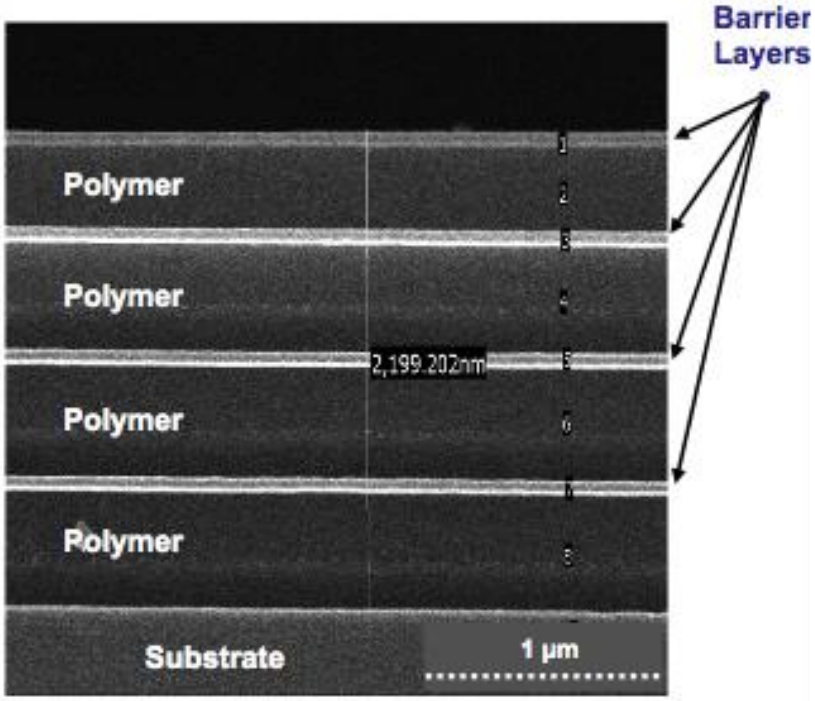
Conformal plasma polymerized polymer coating

Large area
Rough surface



Barrier coatings

Samsung Mobile Display 4.5-inch prototype flexible AMOLED display. (Photo: Samsung Mobile Display)

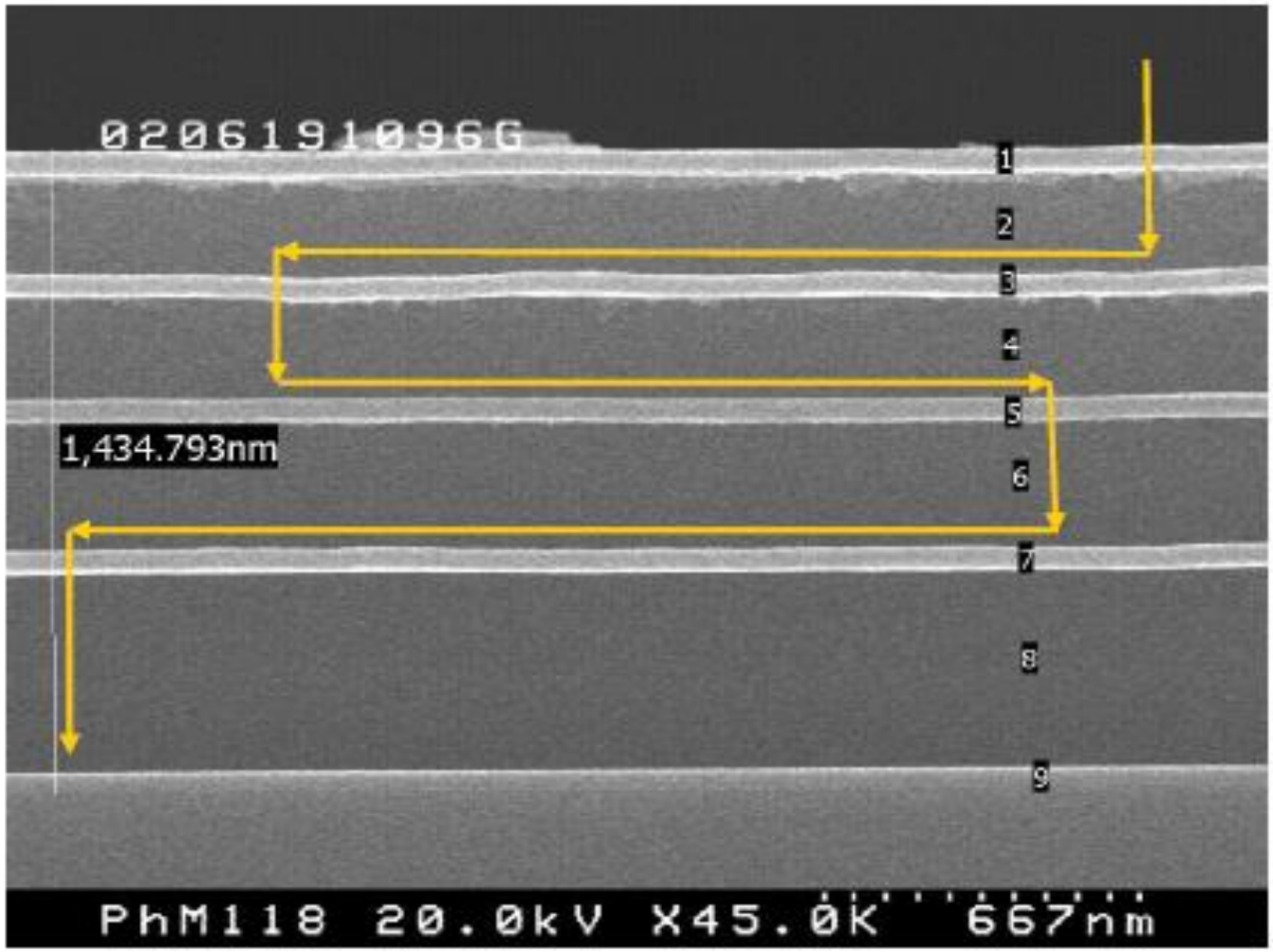


Images courtesy of

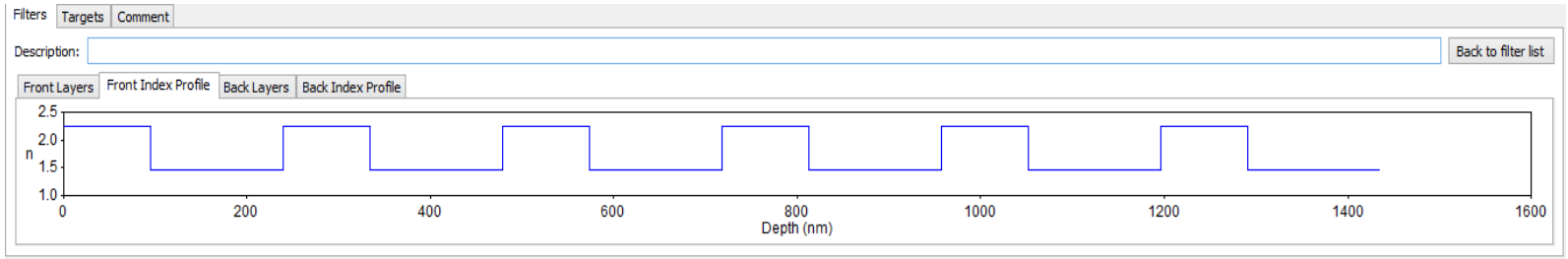
SAMSUNG

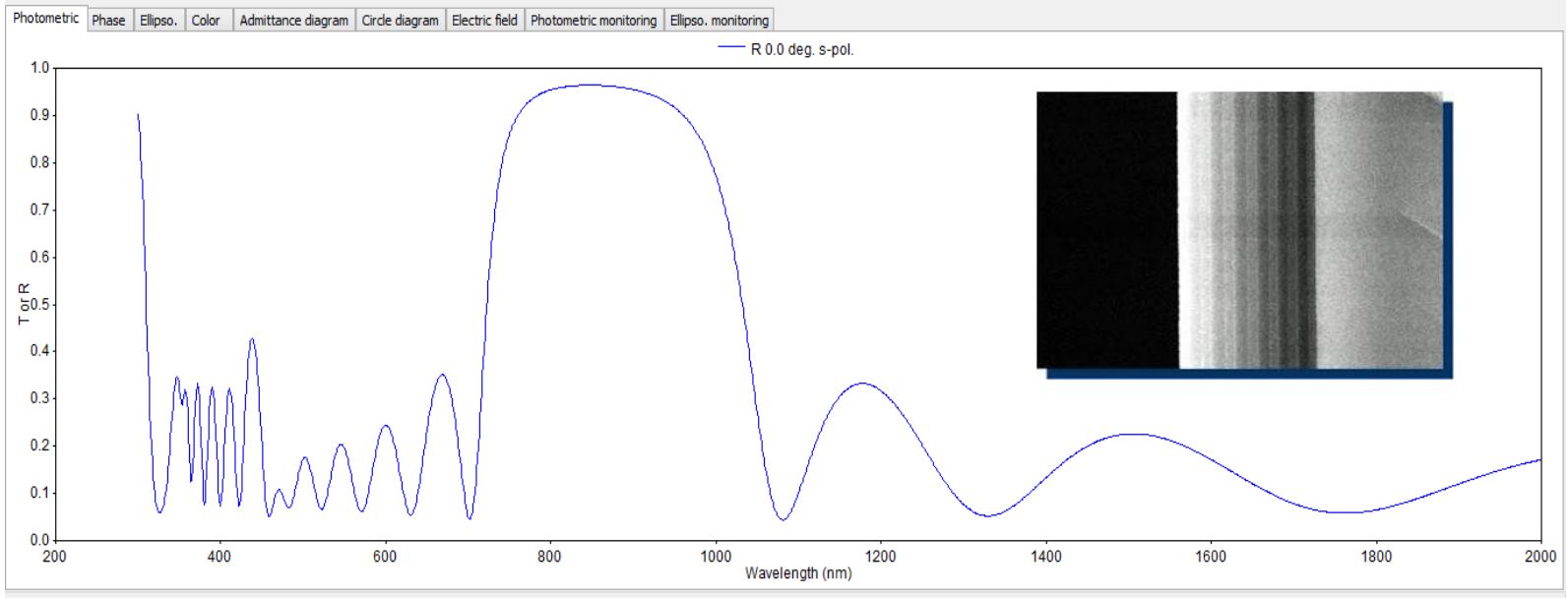
VITEX SYSTEMS

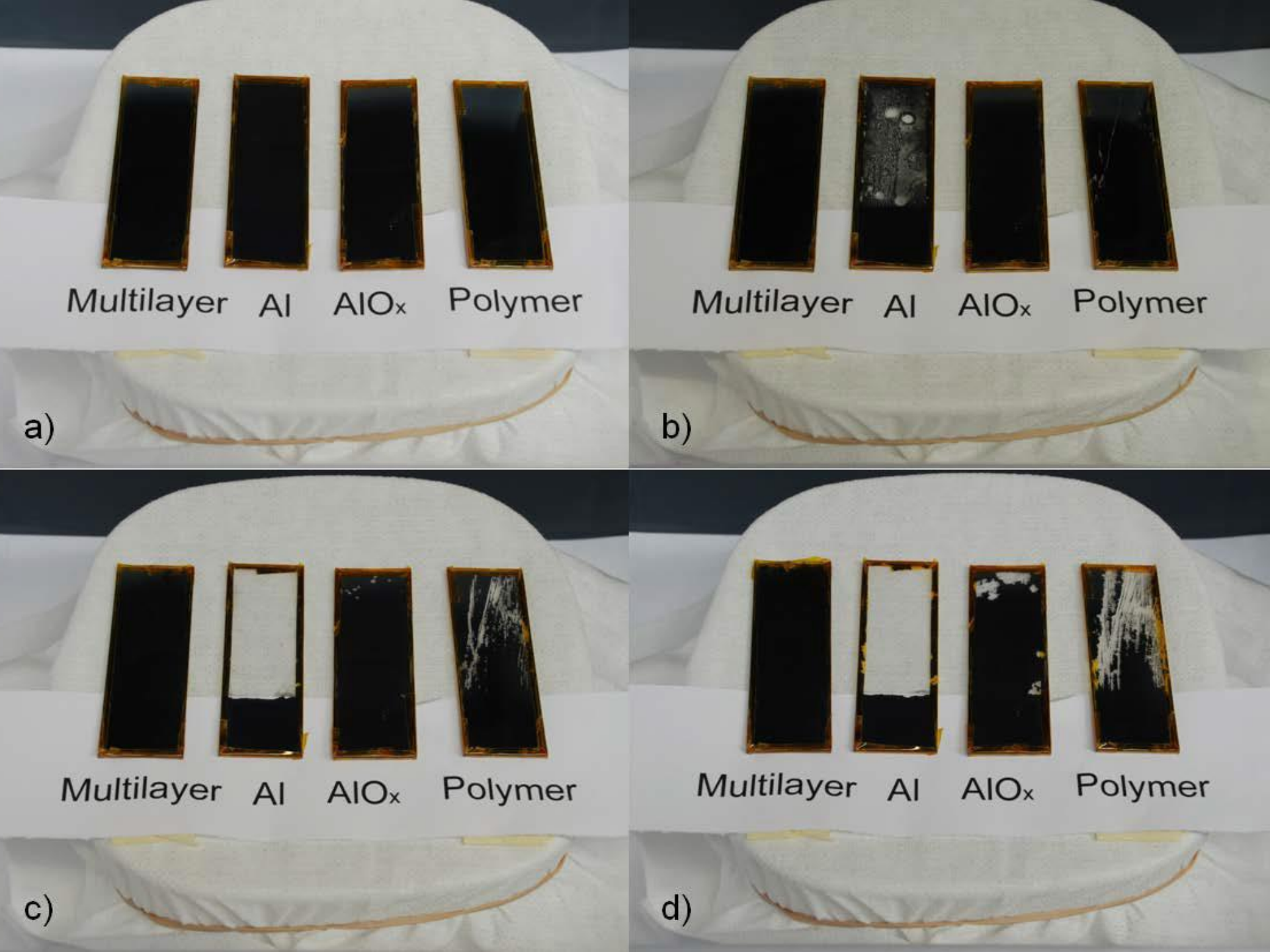
Barrier coatings



Flexible Bragg reflectors






Multilayer
Al
AlOx
Polymer
a)
Multilayer
Al
AlOx
Polymer
b)
Multilayer
Al
AlOx
Polymer
c)
Multilayer
Al
AlOx
Polymer
d)

Encapsulation of electronics

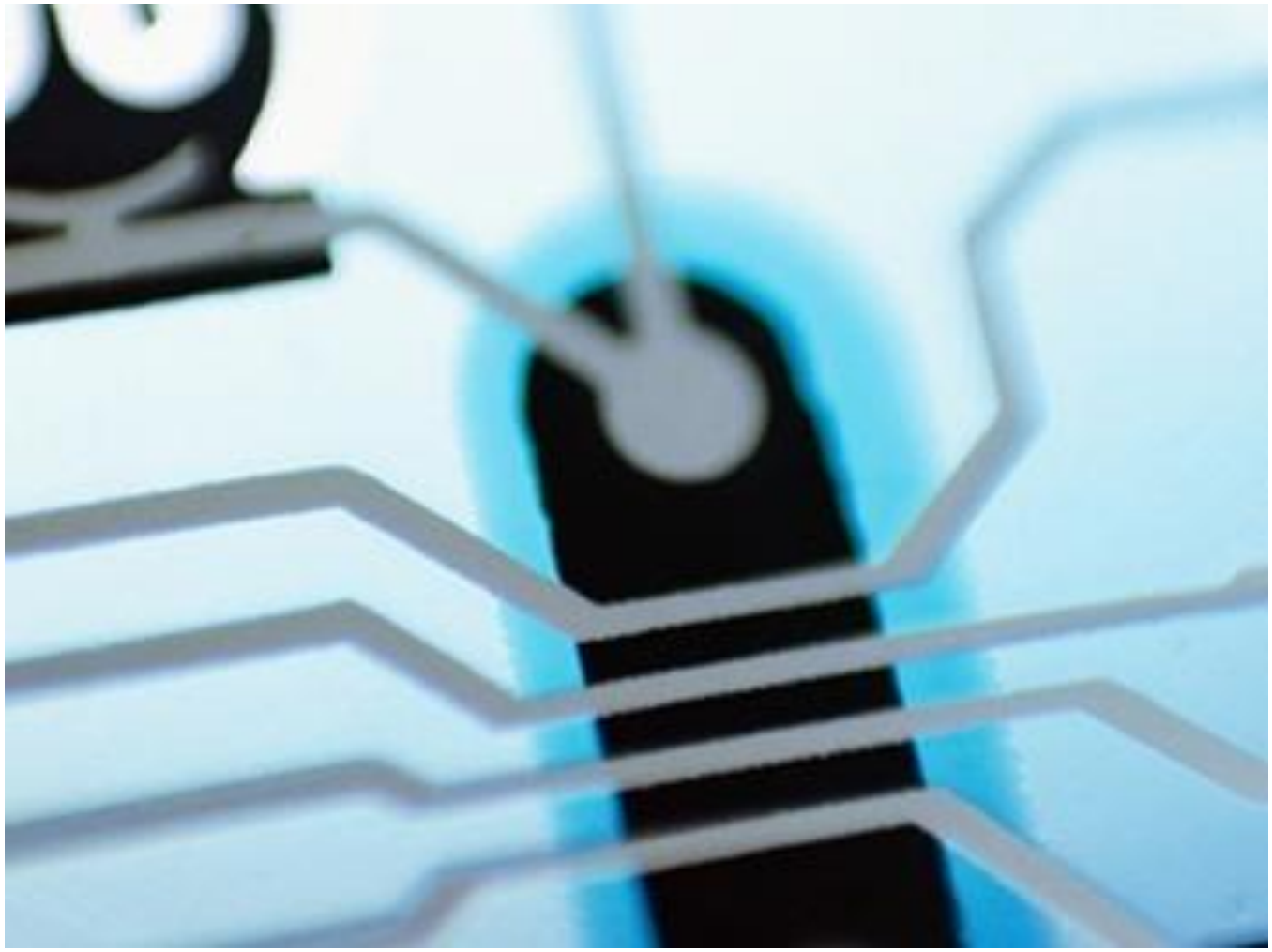


Image courtesy of Graphene Light

Oxygen barriers for food preservation

In conclusion…

The PulseFlo™ technology gives a new dimension to sputtering

- Faster and cheaper production of existing devices
- Optimizing current materials by gaining control over deposition
- New material combinations

NEW DEVICES

Many thanks to

GENCOA

Victor Bellido-González
Dermot Monaghan
Benoit Daniel
Joseph Brindley

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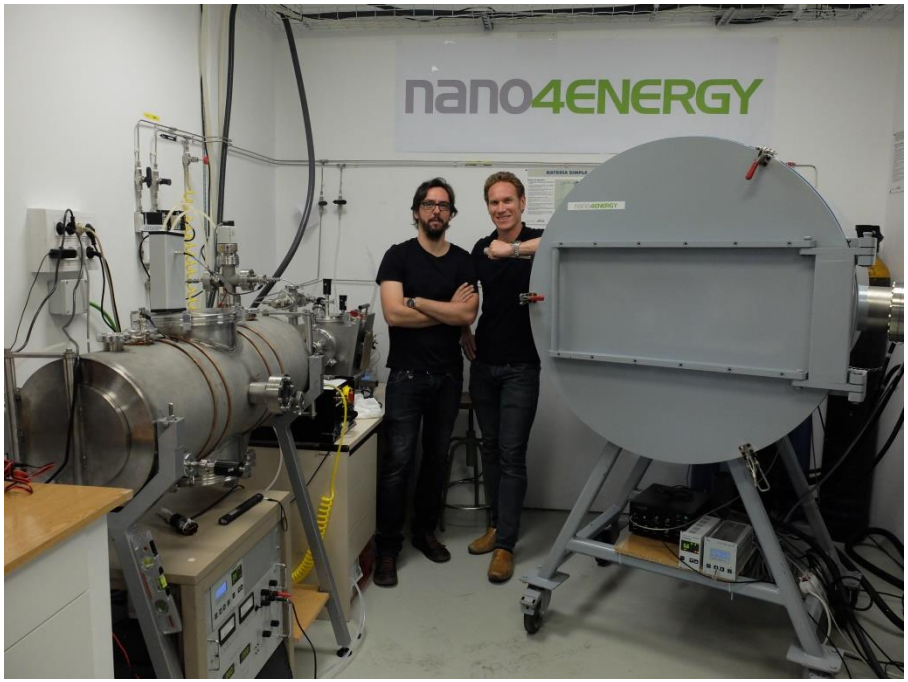
CSIC

Fernando Briones

Graphene Light

Javier Martinez

Laboratory



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Thank you for your attention!

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