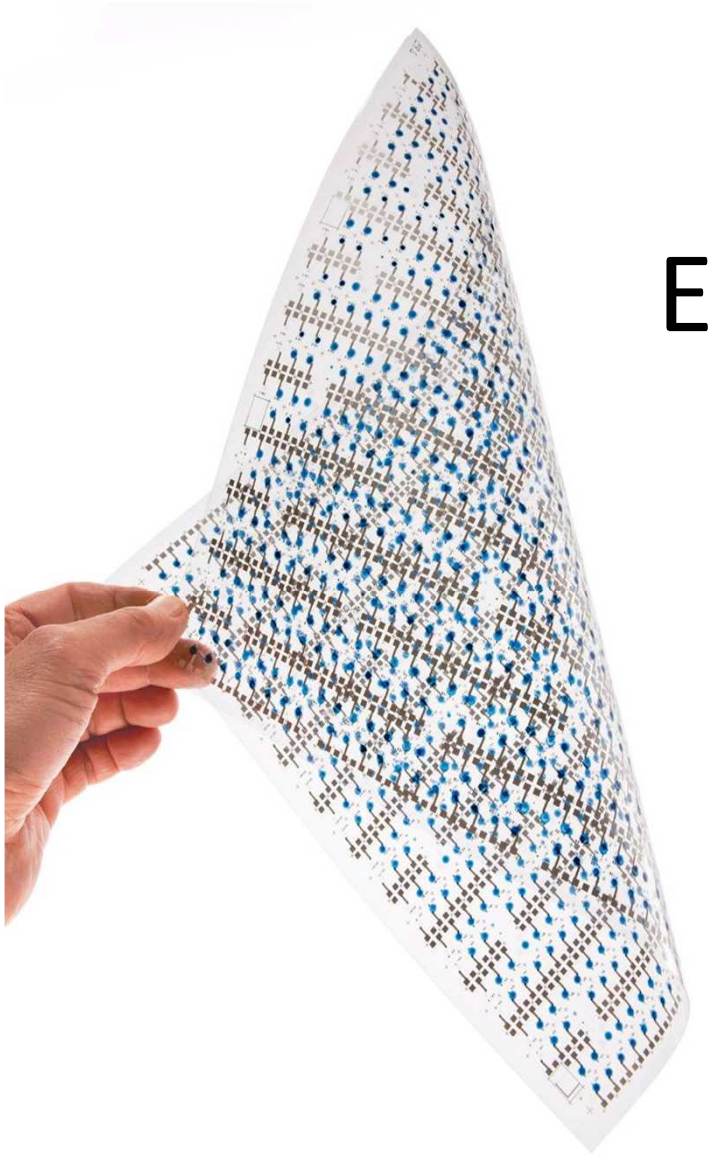
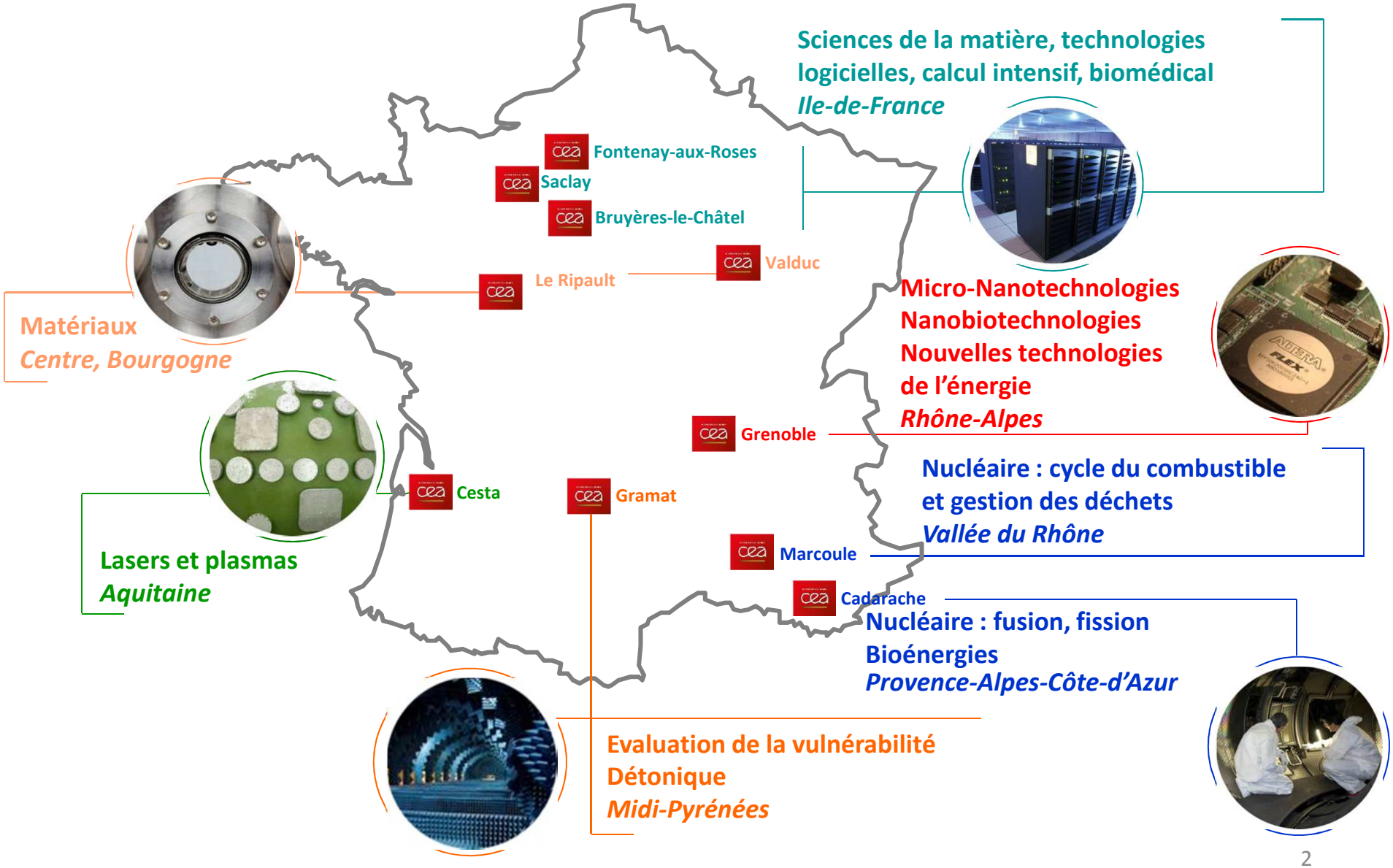


Electronique organique

Jean-Marie VERILHAC
verilhacjm@cea.fr
CEA Grenoble
17 Juin 2014

Commissariat à l'énergie atomique et aux énergies alternatives



Les axes stratégiques

Défense et sécurité globale

Très grandes infrastructures de recherche

Energies bas carbone

Technologies pour l'information et la santé

Recherche fondamentale

Enseignement supérieur et formation

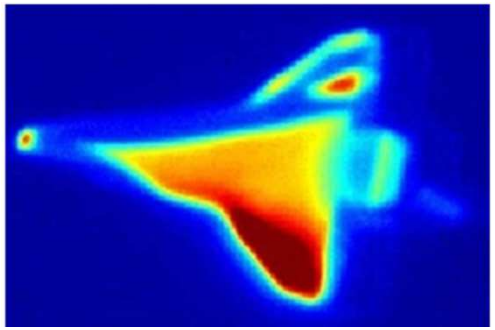
Valorisation et diffusion technologique

La défense et la sécurité globale.

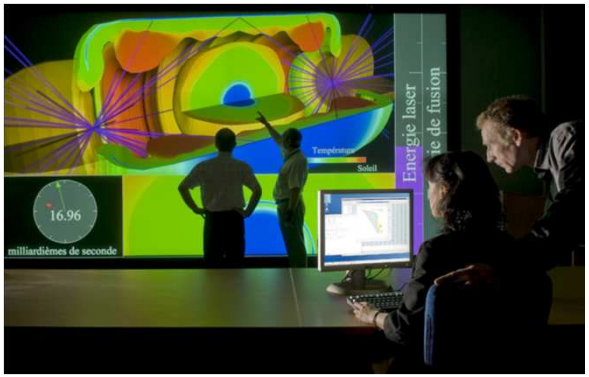
1960 gerboise bleue
1er essais nucléaire français

Le Triomphant

Le Charles de Gaulle



Furtivité



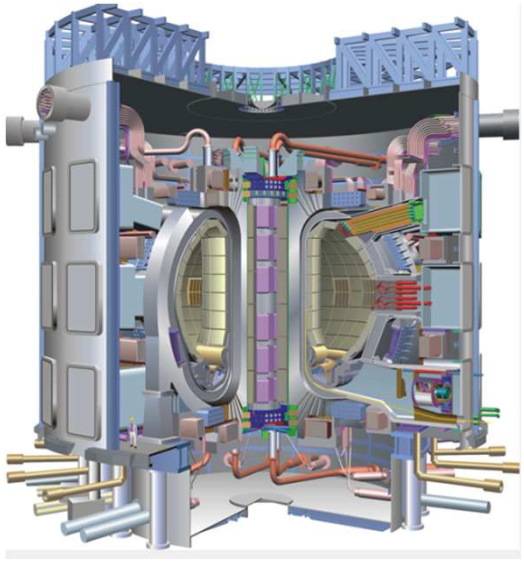
1996 Programme Simulation
+ expérimentation LMJ

Sofradir (Militaire)

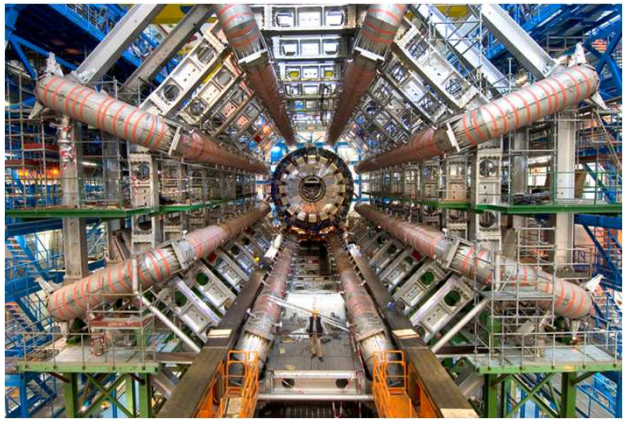
Ulis (Civil)

Les très grandes infrastructures de recherche,

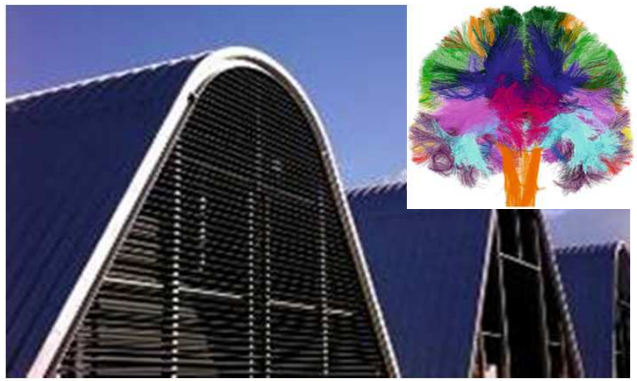
Laser mégajoule

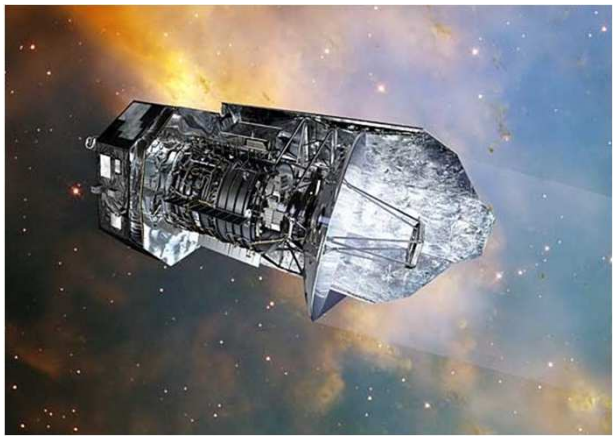


Iter (fusion nucléaire)



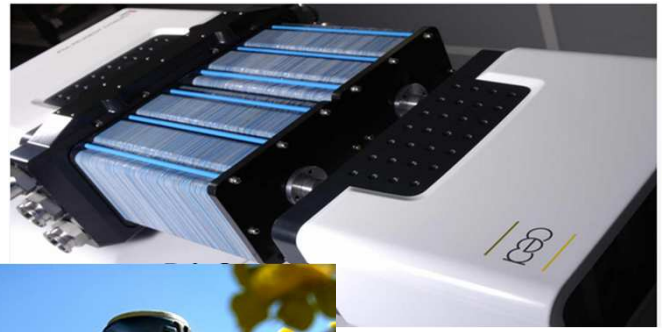
CERN



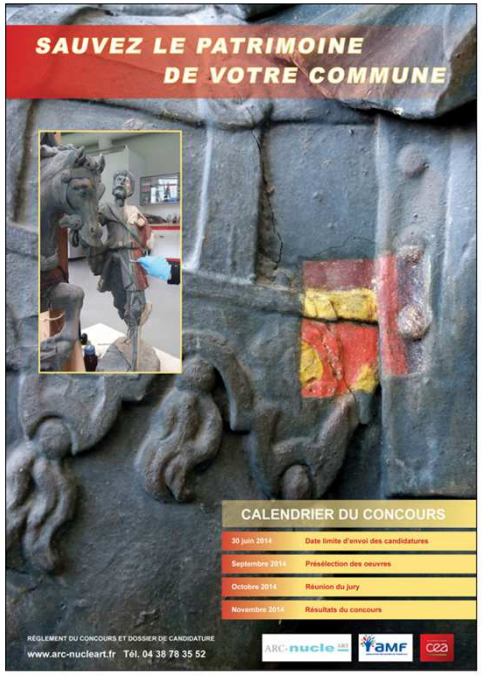


Herschel (infrarouge)

Les énergies bas carbone (nucléaire et renouvelables),

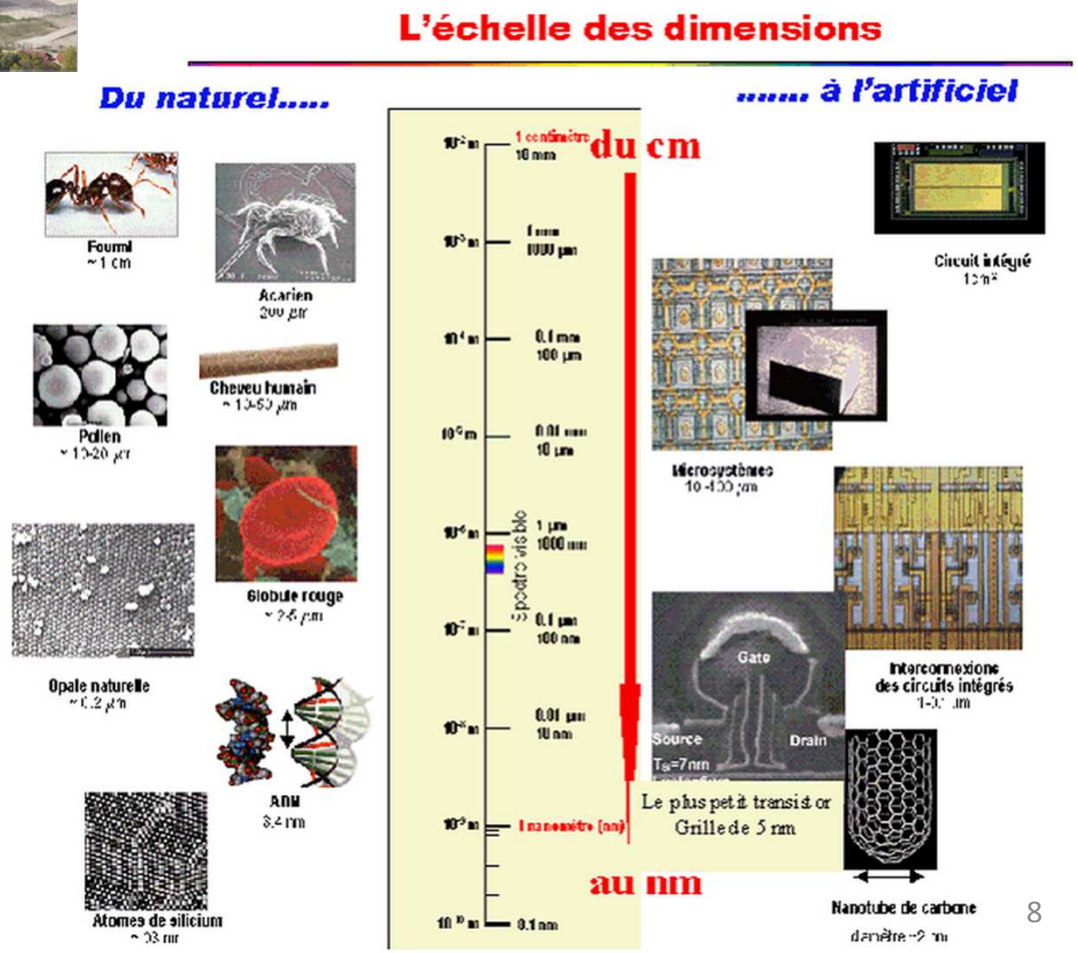


Quand le nucléaire mène à l'art: ARC-Nucleart



Les technologies pour l'information et les technologies pour la santé

MINATEC (Grenoble)

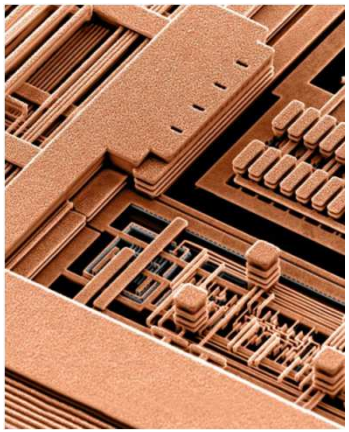


Microélectronique et Nanotechnologies

Objets quotidiens…

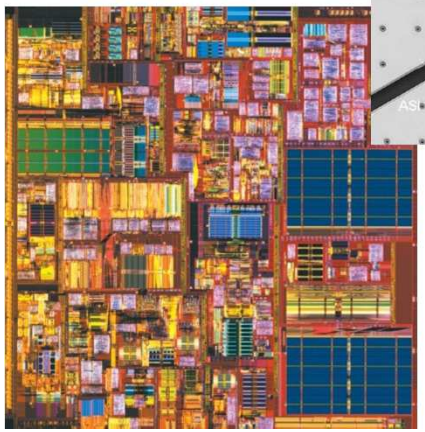
… et ce qui se cache dessous

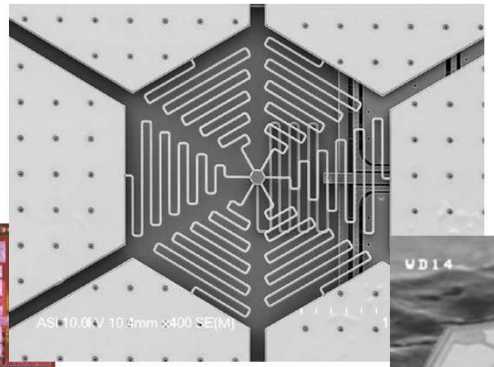
transistor



Interconnections

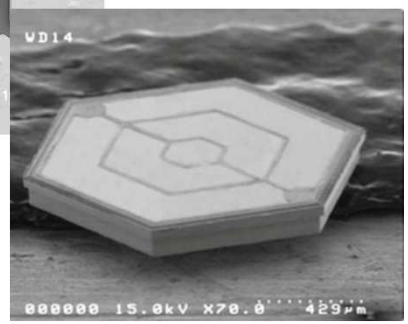
Circuits intégrés



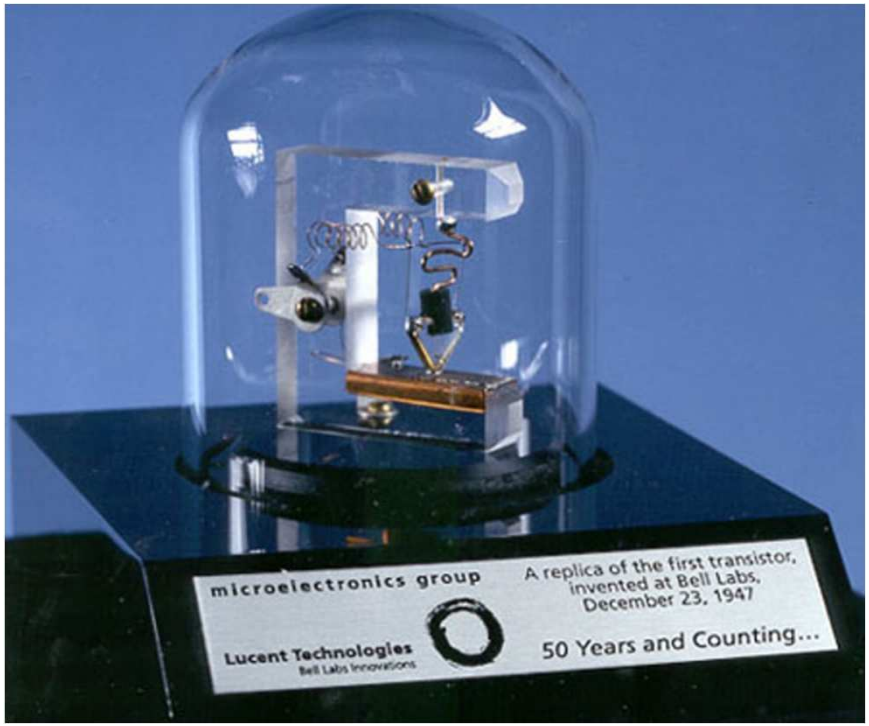


MEMS (capteurs de mouvements)

LED

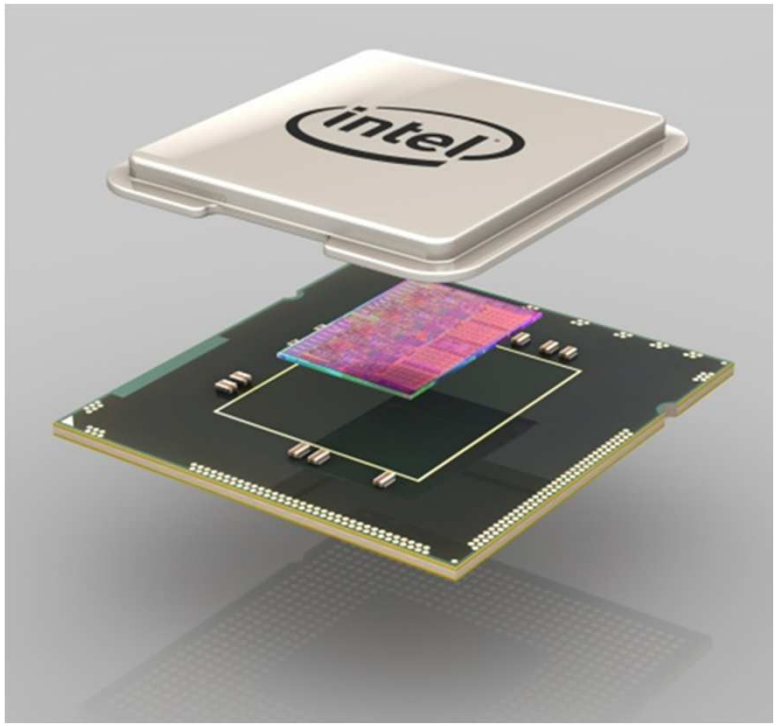


1947



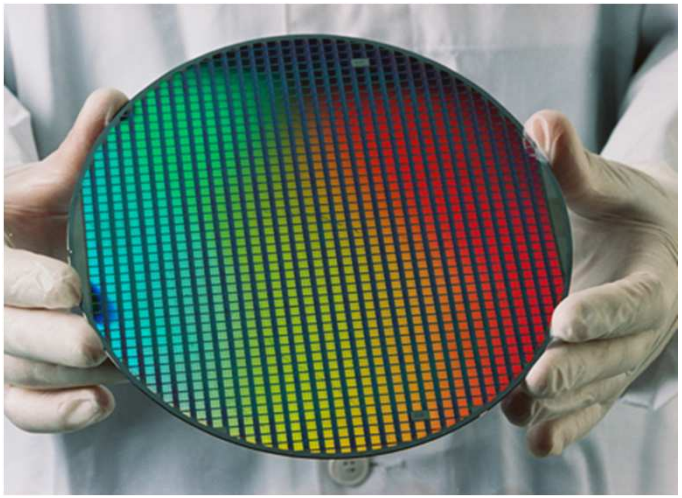
1 transistor/cm²

2014



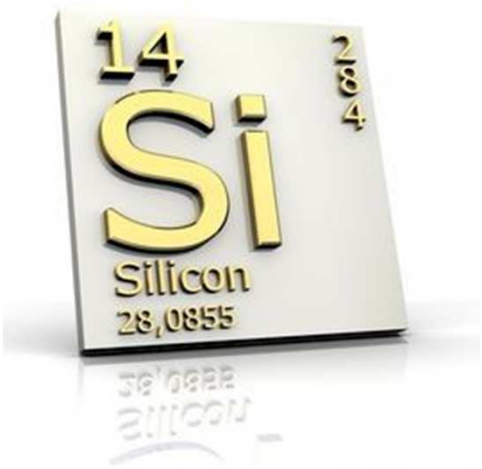
1 milliard transistors/cm²

Salles blanches

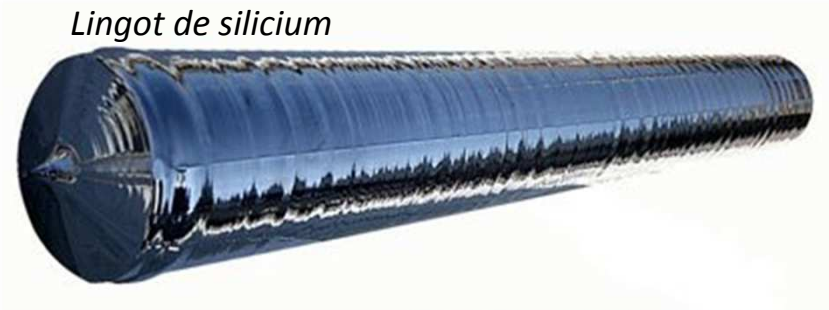


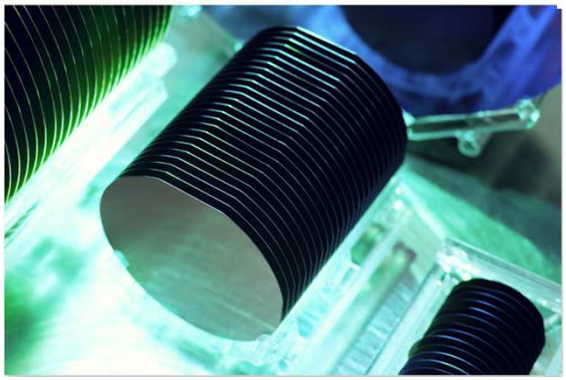
	particules /m³					
Classe	**0,1 µm**	**0,2 µm**	**0,3 µm**	**0,5 µm**	**1 µm**	**5 µm**
ISO 1	10	2	0	0	0	0
ISO 2	100	24	10	4	0	0
ISO 3	1 000	237	102	35	8	0
ISO 4	10 000	2 370	1 020	352	83	0
ISO 5	100 000	23 700	10 200	3 520	832	29
ISO 6	1 000 000	237 000	102 000	35 200	8 320	293
ISO 7	∞	∞		352 000	83 200	2 930
ISO 8	∞	∞	∞	3 520 000	832 000	29 300
ISO 9	∞	∞	∞	35 200 000	8 320 000	293 000

Microélectronique traditionnelle (technologie du Silicium)



Lingot de silicium

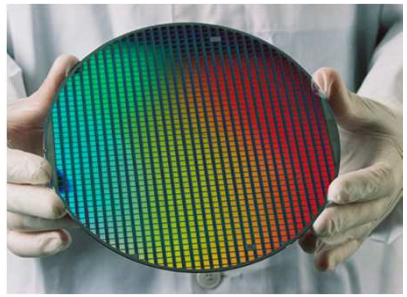


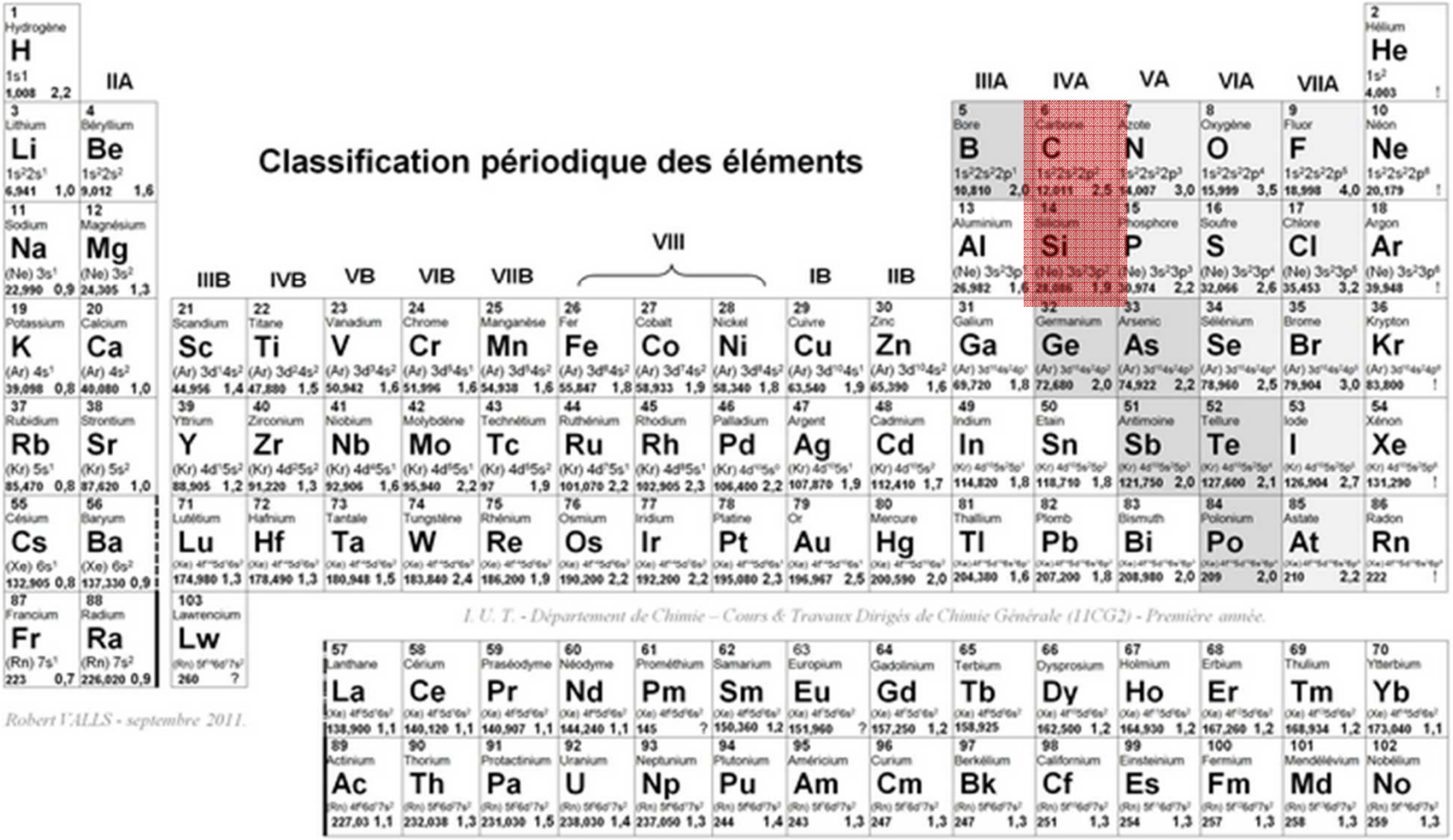


Wafer de silicium

Chiffre d'affaire 2013

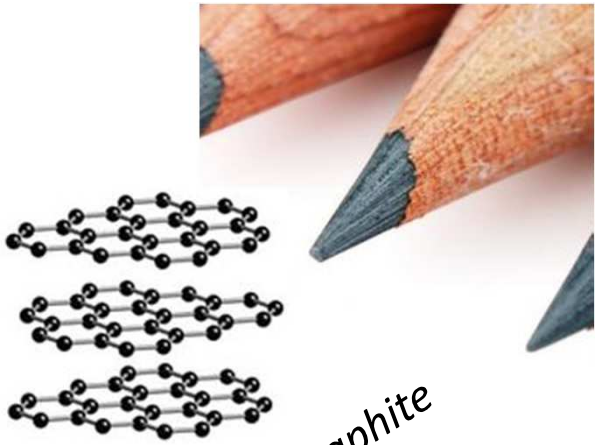
- IBM ~ 100 milliard de $
- Intel ~ 53 milliard de $
- ST Microelectronic ~ 6 milliard de $



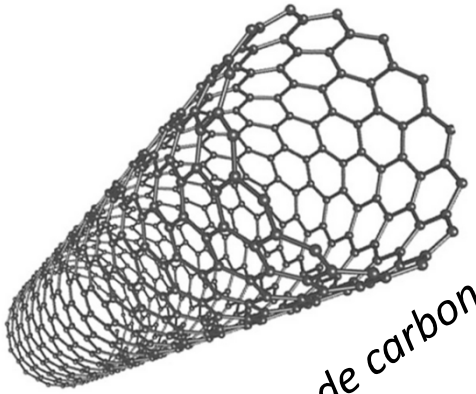

Classification périodique des éléments
IIA
IIIA
IVA
VA
VIA
VIIA
IIIB
IVB
VB
VIB
VIIB
VIII
IB
IIB
Robert VALLS - septembre 2011.
I. U. T. - Département de Chimie – Cours & Travaux Dirigés de Chimie Générale (1ICG2) - Première année.

Les formes du carbone

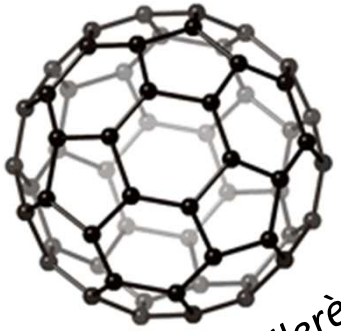
Diamant



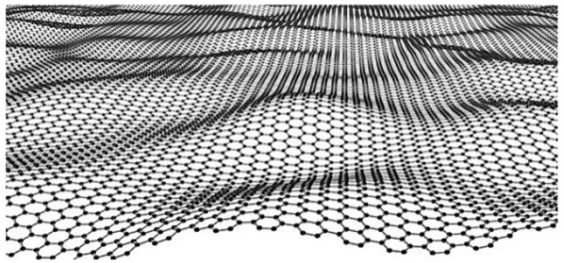
Graphite



Nanotube de carbone

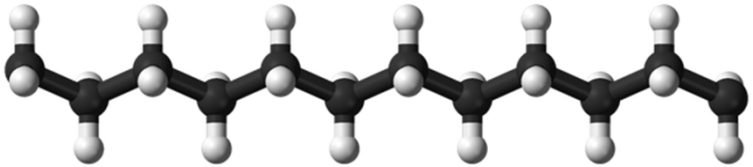


Fullerène

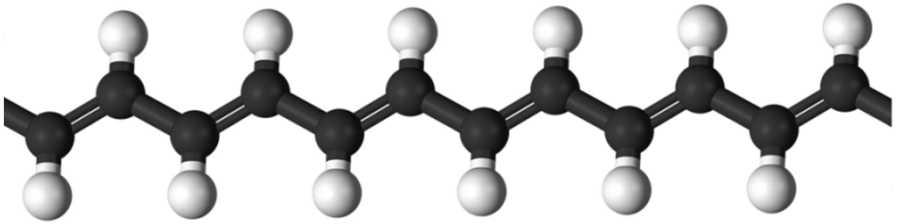


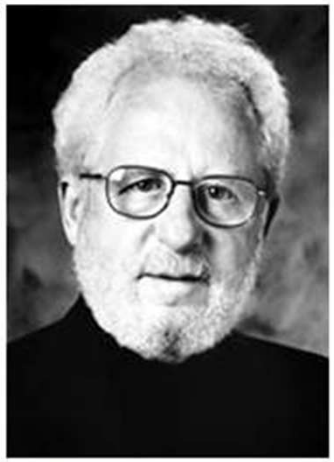
Graphène

Polymère



Des plastiques conducteurs d'électricités





Alan J. Heeger

Alan G. MacDiarmid

Hideki Shirakawa

The Nobel Prize in Chemistry 2000 was awarded jointly to Alan J. Heeger, Alan G. MacDiarmid and Hideki Shirakawa *"for the discovery and development of conductive polymers"*.

- ✓ Matériaux aux propriétés optiques et électroniques proches du Silicium,
- ✓ Possible de les mettre en œuvre dans des encres imprimables.

À la frontière entre 2 mondes

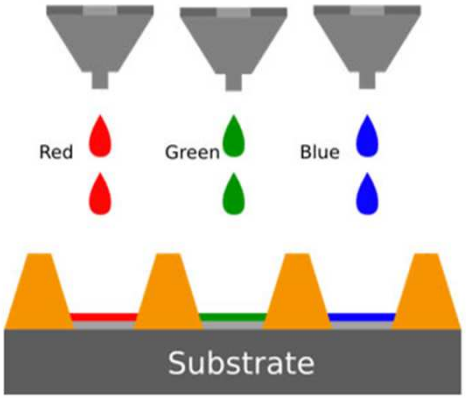
Microélectronique

Impression

Electronique organique ou électronique imprimée

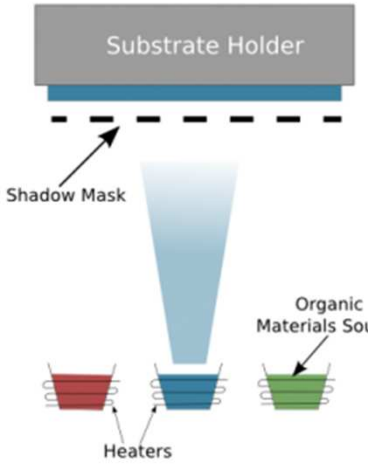
Mise en œuvre des matériaux organiques

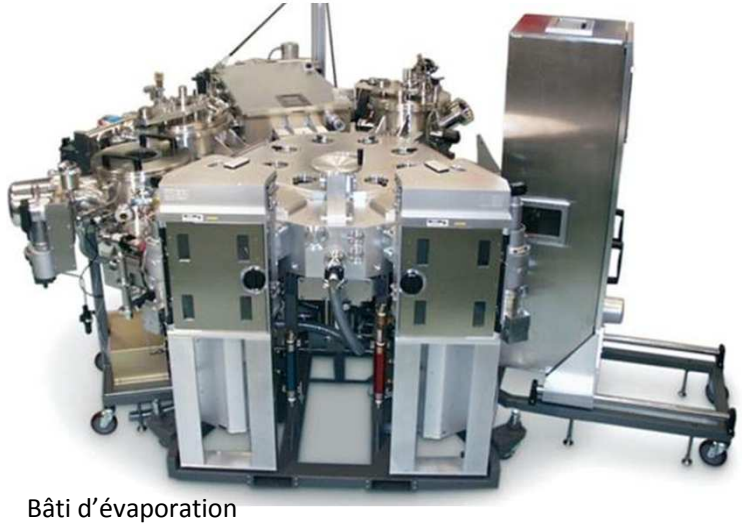
Encres/impression



Machine jet d'encre

Poudre/évaporation

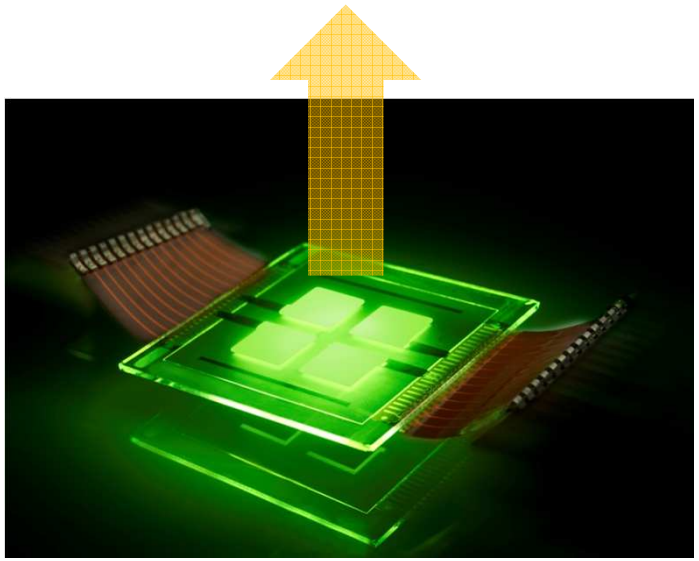




Bâti d'évaporation

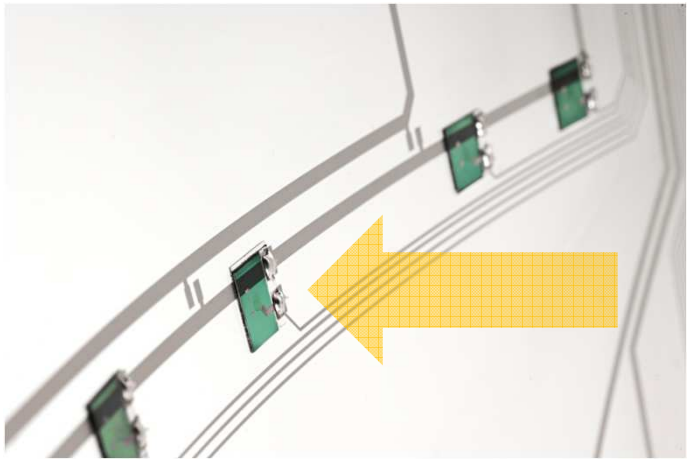
Emission de lumière

→ OLEDs



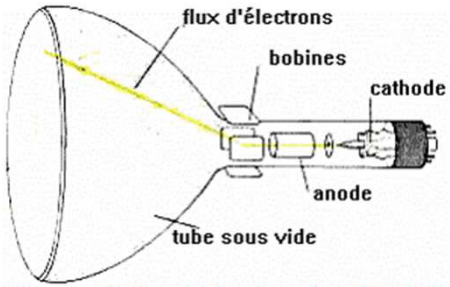
Capture de lumière

→ Photodétecteurs organiques

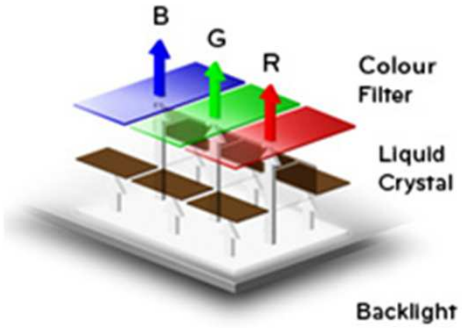


Technologies des écrans

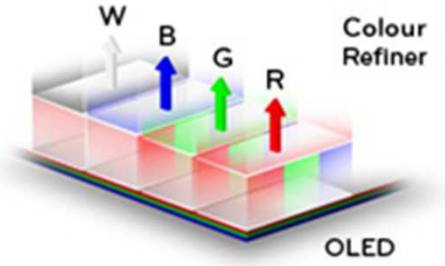
Tube cathodique



LCD

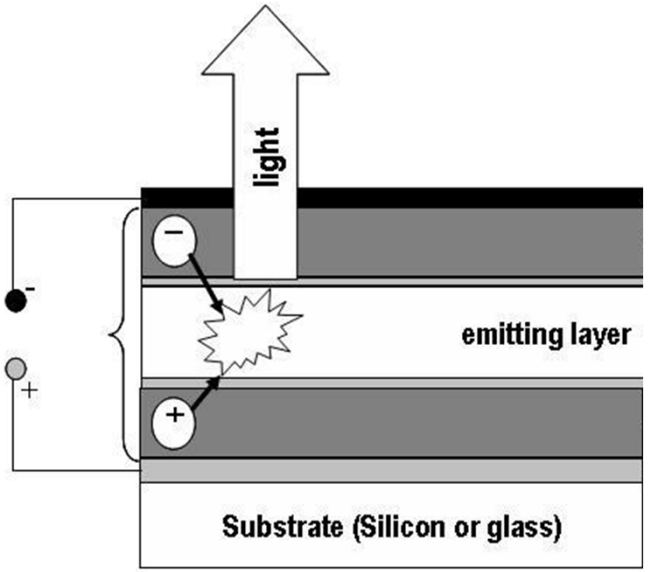


OLED

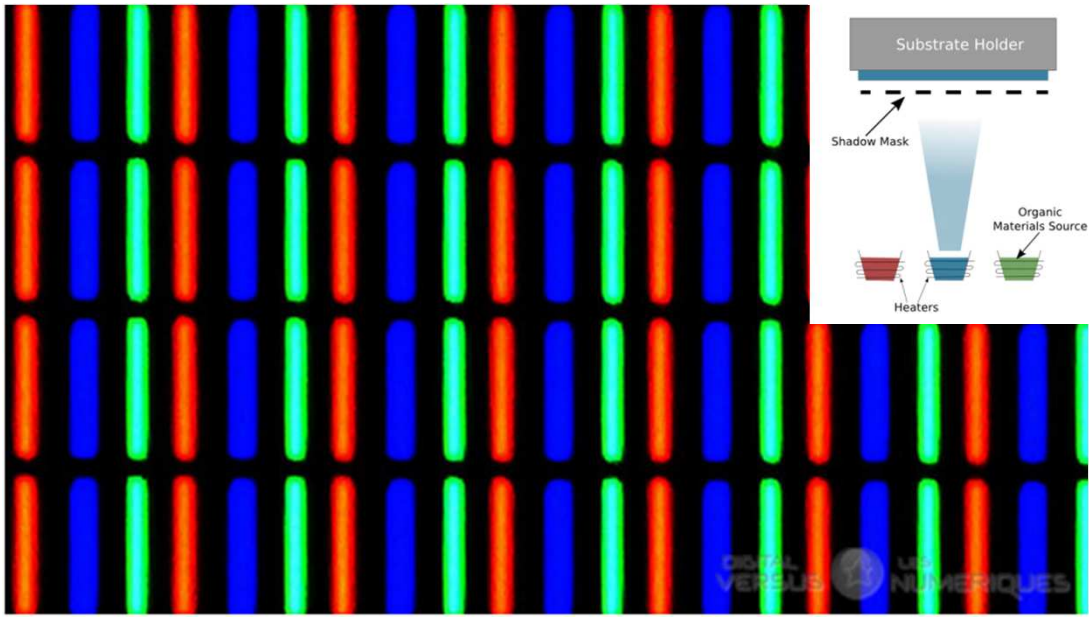


OLED (Organic Light Emitting Diodes)

Principe basé sur l'électroluminescence ou l'électrophoshorescence de molécules organiques.

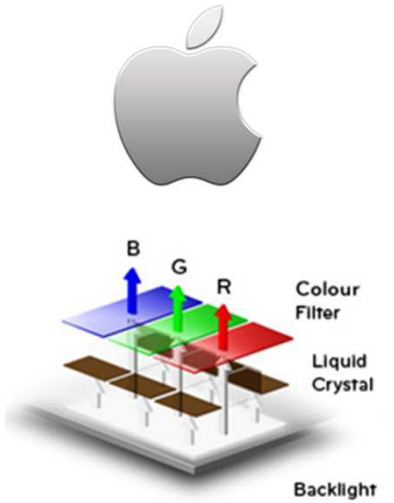


Transforme un courant électrique en lumière

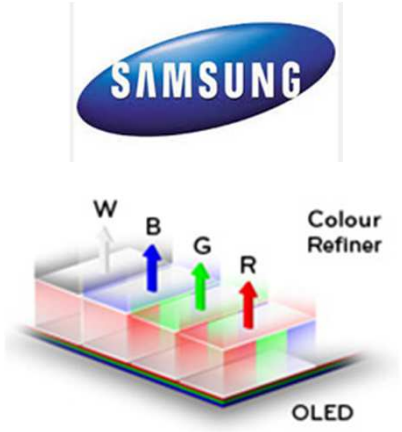


Zoom sur une série de pixels (RVB)

1ère « vraie » application: Smartphone



Technologie LCD

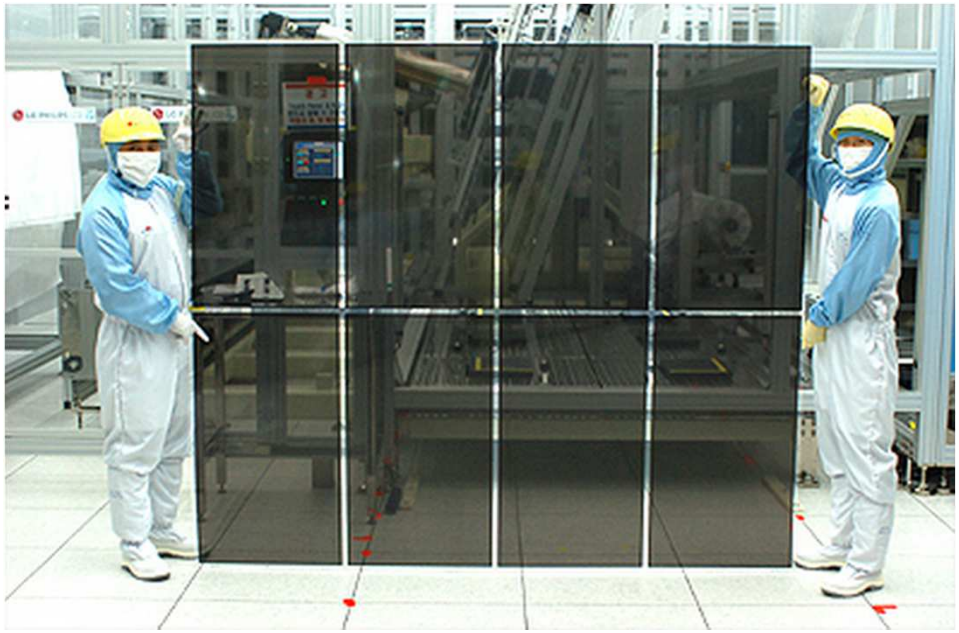


Technologie OLED

Avantage des écrans OLED vs LCD:

- ❑ Pas de rétroéclairage,
- ❑ Consommation réduite,
- ❑ Noir plus intense,
- ❑ Image plus lumineuse,
- ❑ Écran moins épais,
- ❑ Possibilité d'avoir des écrans souples,
- ❑ Etc…

Les écrans de télévision OLED

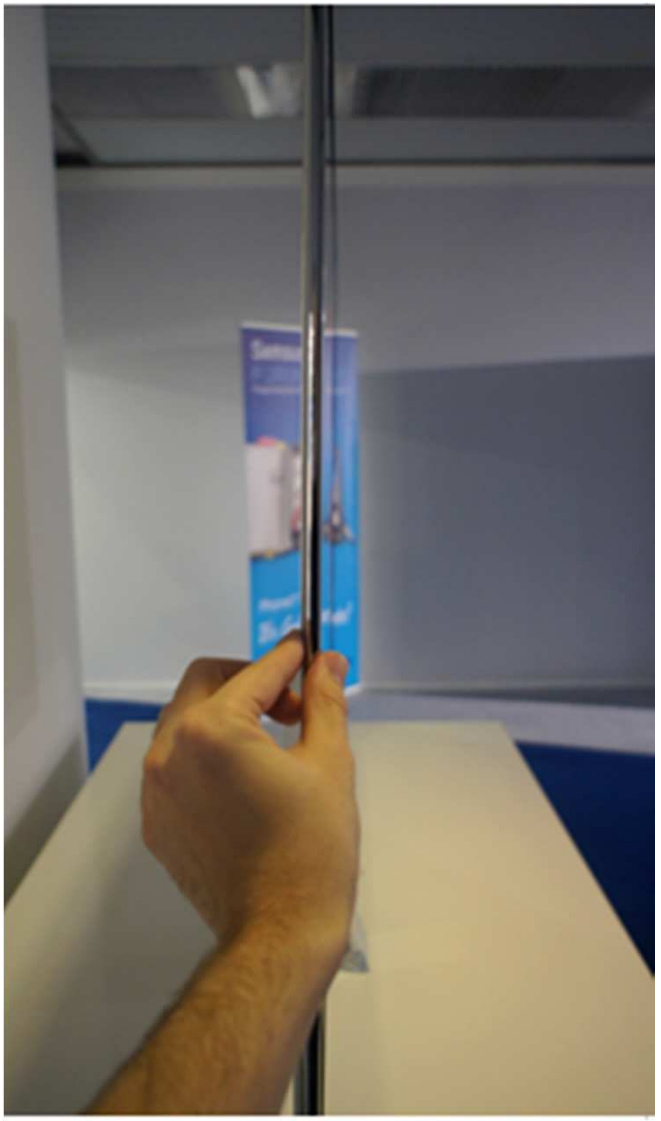


Génération 7 de taille de dalles de verre

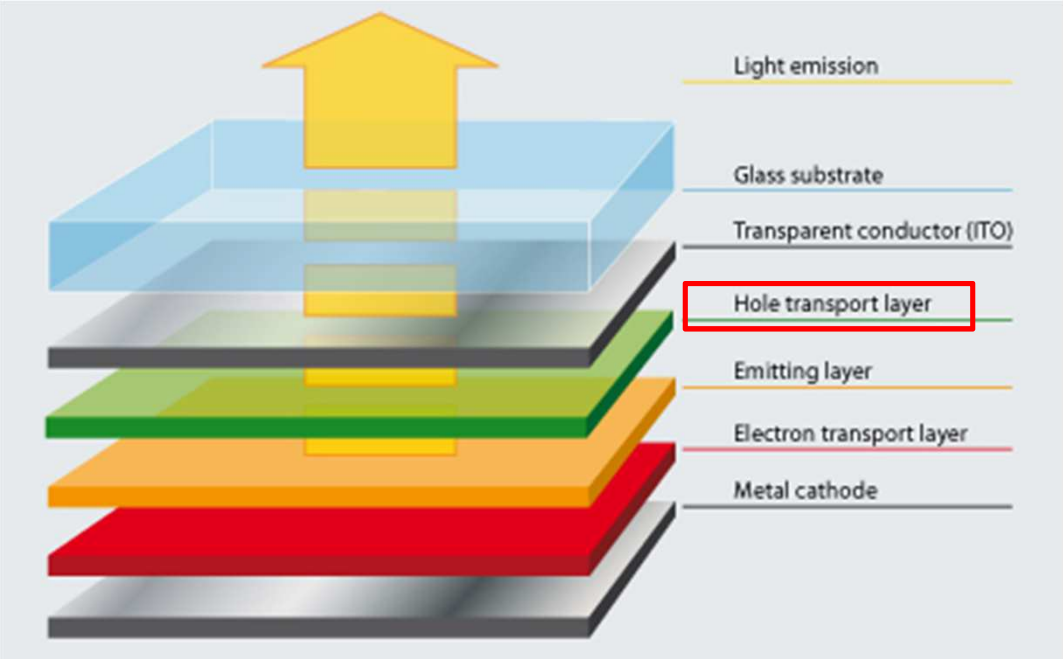
Panasonic

Usine OLED Samsung Gen8

Les écrans de télévision OLED

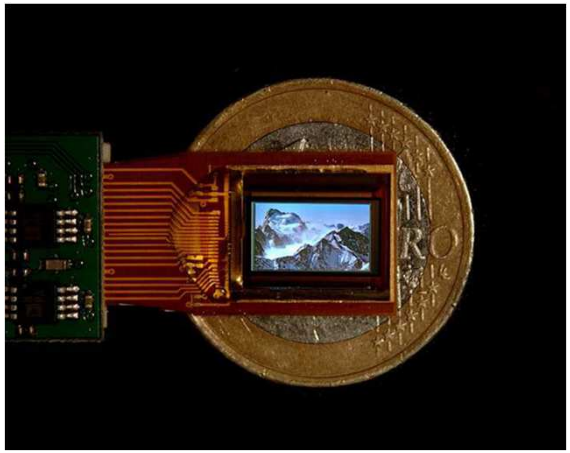


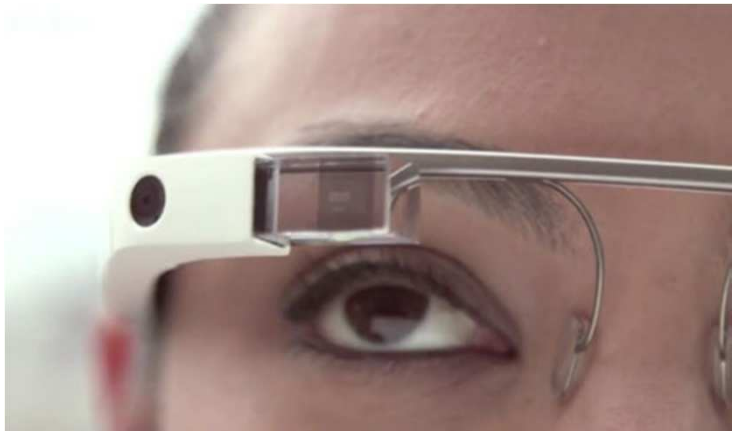
Une couche qui vaut de l'or



Novaled racheté par Samsung 260M€ en 2013

MicroOLED (start up du CEA Grenoble)

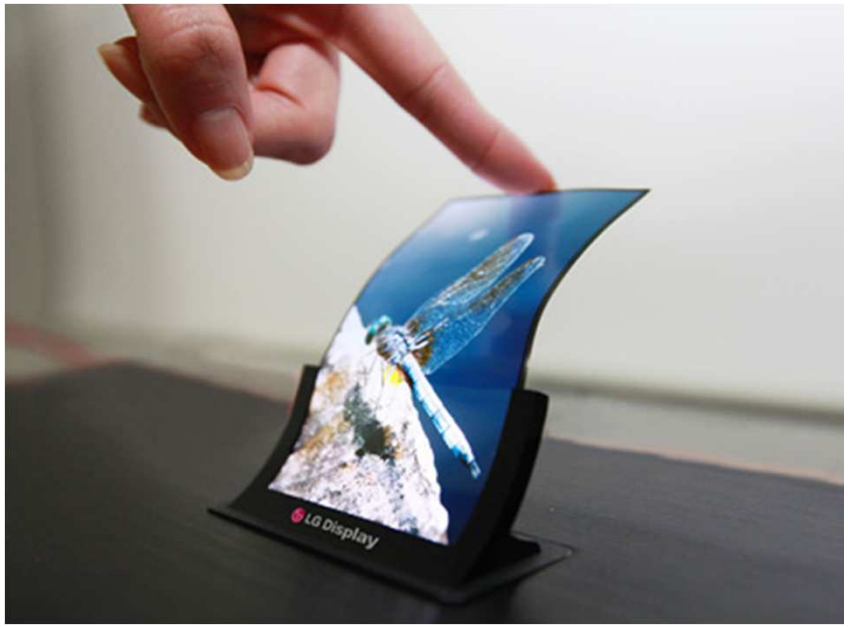




Concept Google glass

Viseur caméra

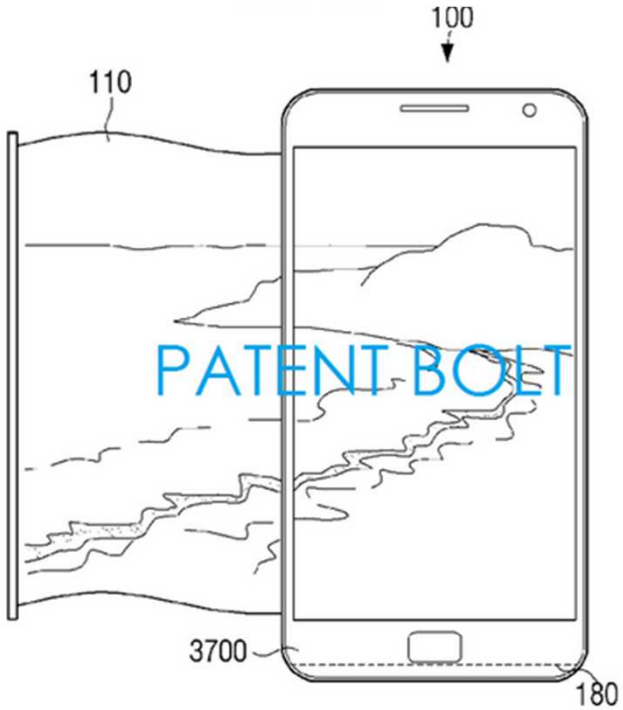
À venir: les écrans OLED flexible



Ecran souple Samsung (YOUM 2015)

http://www.youtube.com/watch?v=pzq0rKK5Kb0

Ecrans enroulables



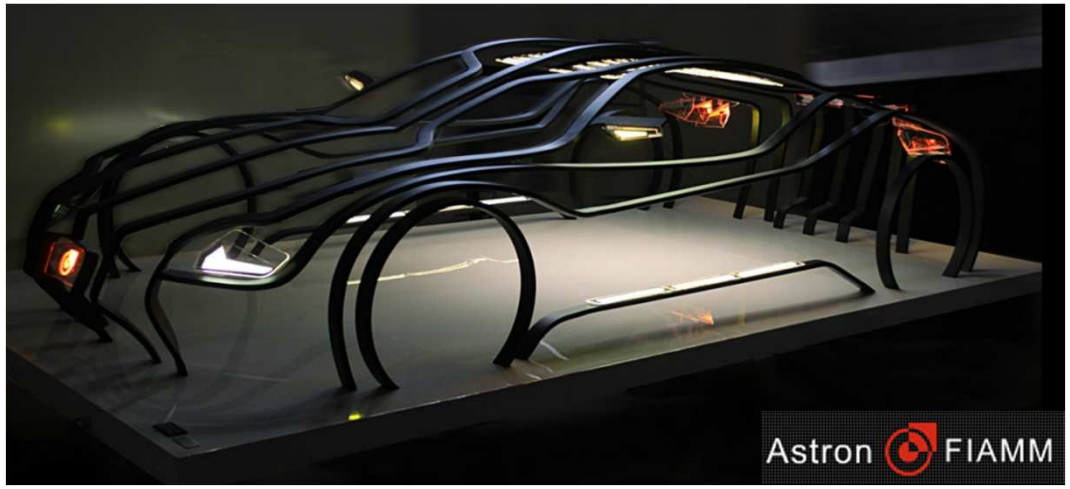
Nombreux brevets déposés

Ecran OLED transparent

Film Avatar

Démonstrations de concept chez LG et Samsung

OLED pour l'éclairage



Automobile

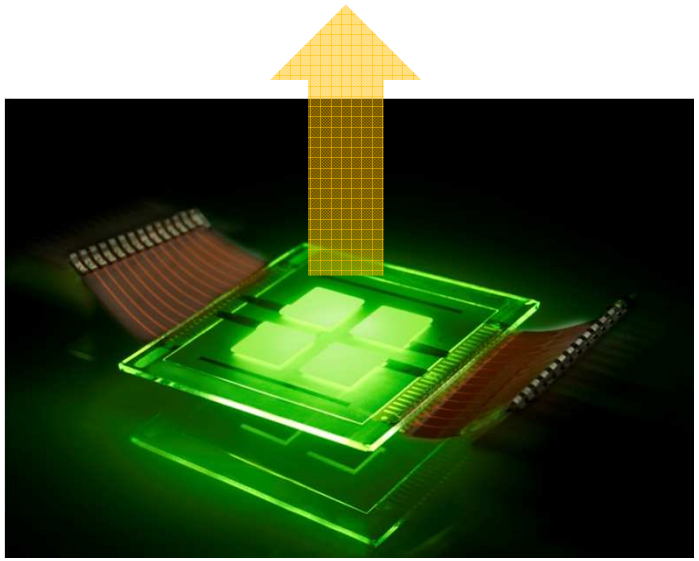
Signalétique

Eclairage technique ou décoratif

Source Astron-fiamm

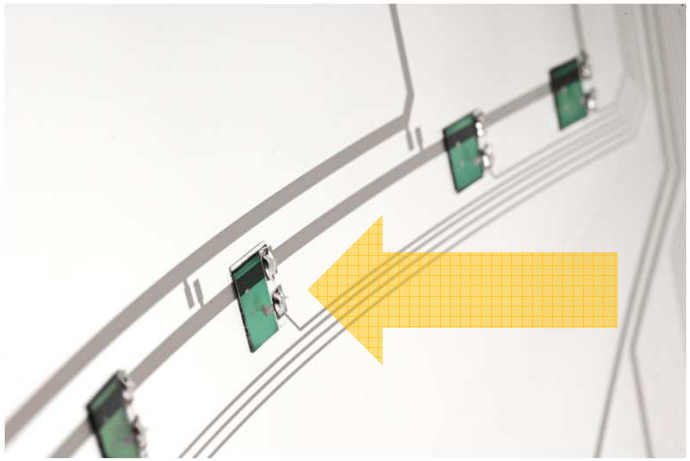
Emission de lumière

→ OLED

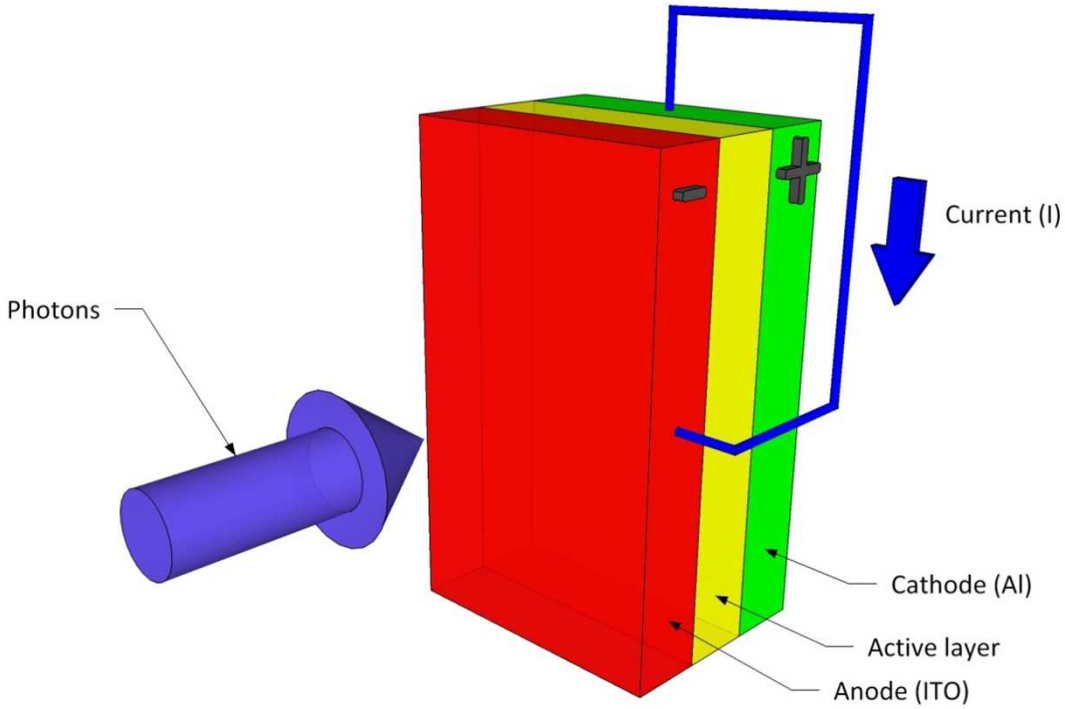


Capture de lumière

→ Photodétecteur organique

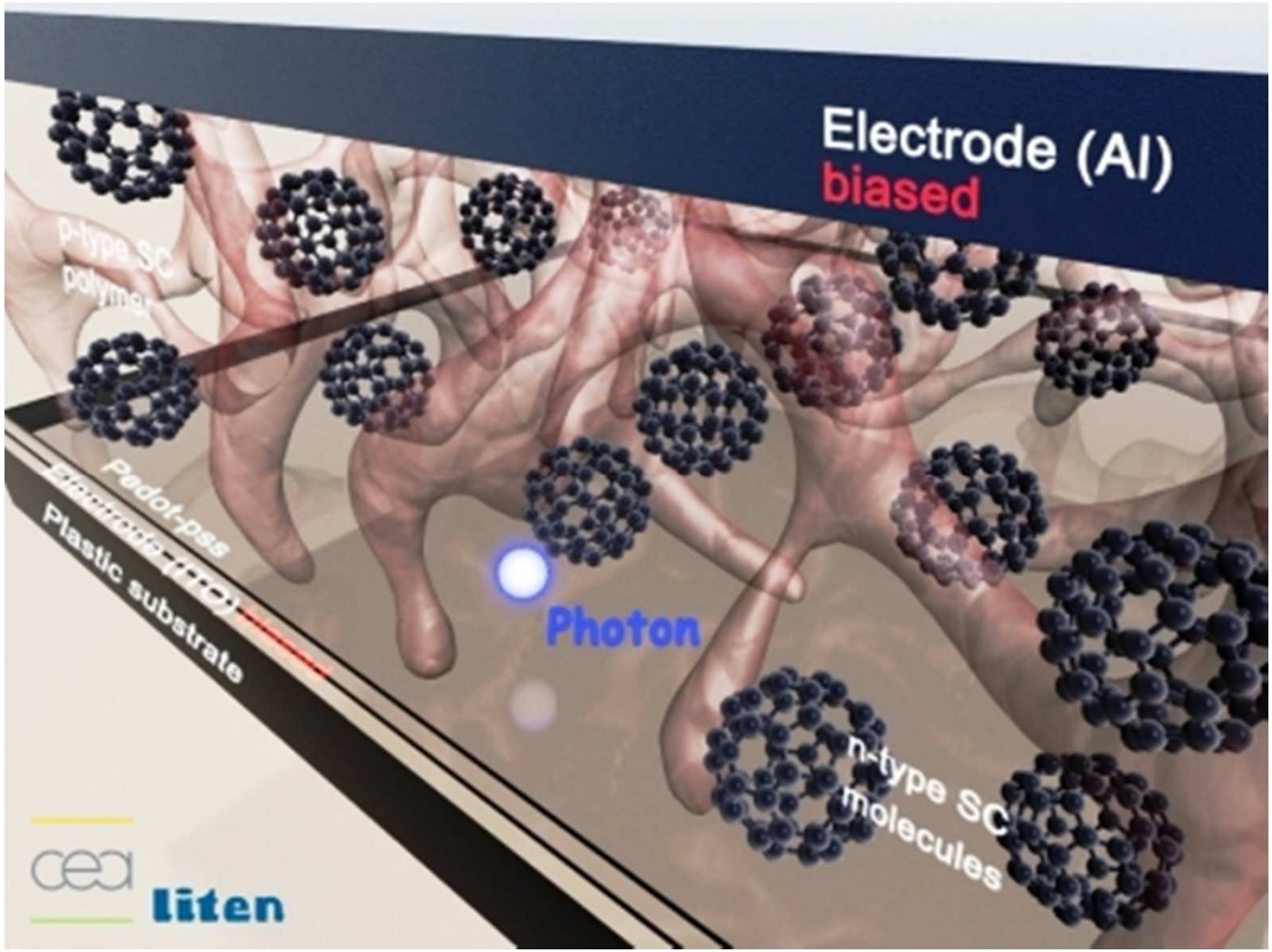


Les photodétecteurs organiques



Transformer la lumière en courant électrique

Couche de photoconversion



Start up ISORG (Image Sensors ORGanic)

Electronics Engineering Times

On Board magazine

Silicon 60

Silicon 60 EETimes (Electronics Engineering Times) :

the list of the 60 startups worldwide with the most promising technology

ISORG in Silicon 60 since 2012

KOREA IT TIMES
Industry & Technology Times

"Take ISORG for example. For this French startup company, it was the first time at Printed Electronics USA. This was a good opportunity to see demos of their printed photo-detector arrays in action."

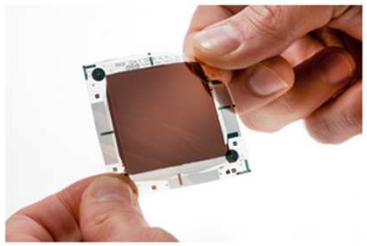
Gartner | 2011 COOL VENDOR

Gartner®

ISORG selected as Cool Vendor 2013 for Imaging & Display as 1 of the 5 worldwide coolest suppliers

New award for Plastic Logic and ISORG's sensor which promises to transform the way we interact with consumer devices

07/04/2014

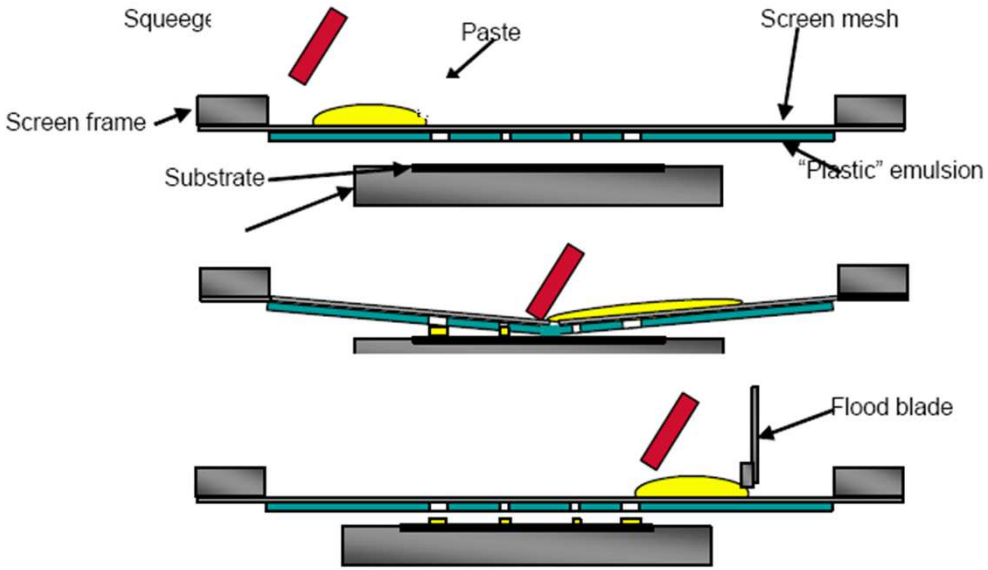


« We find three specific things of coolness for ISORG :

. New products
. Cost effective
. It works »

Impression sous forme d'encres

Sérigraphie

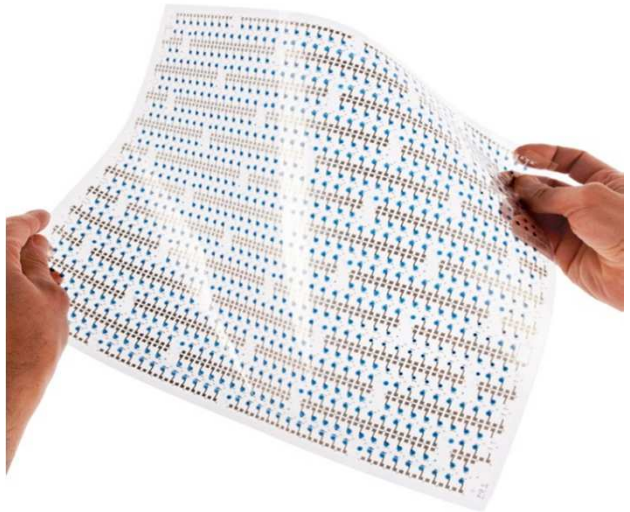


- Électronique grande surface
- Substrats plastiques souples et légers
- Temps de cycles courts

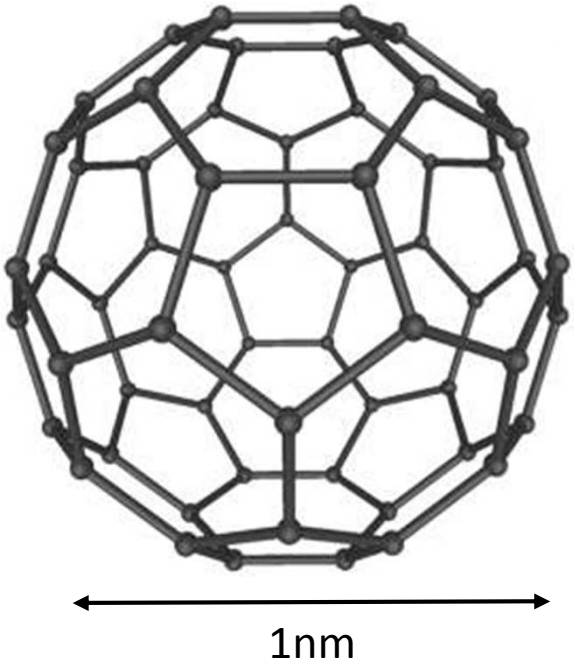
1960

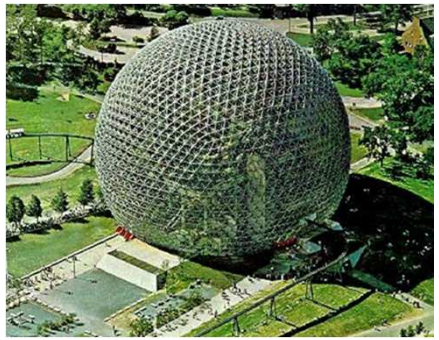
2014

Andy Warhol



Fullerène





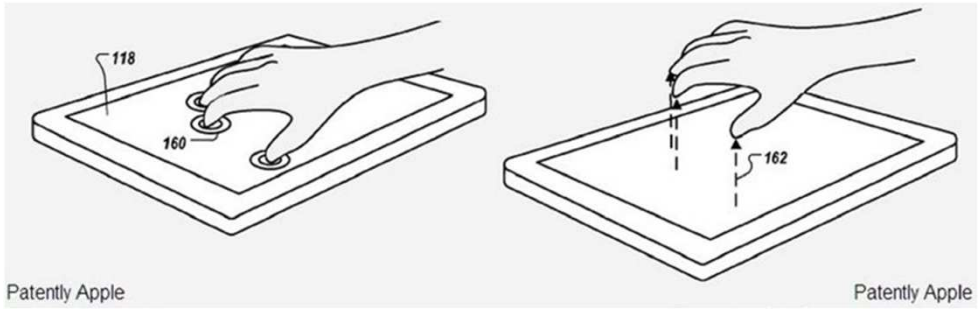
Architecte:
Buckminster Fuller

Exemples d'applications

Affiches interactives

Exemples d’applications

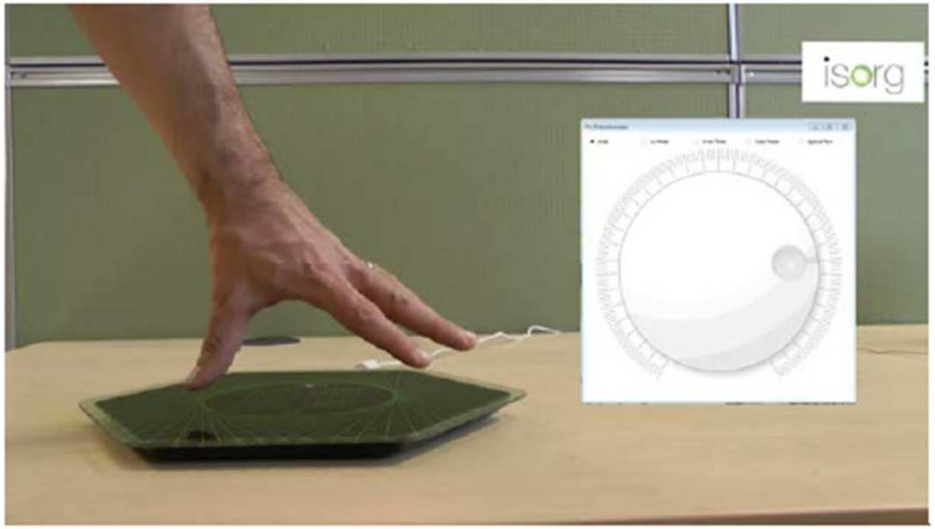
Prochaine génération de tablette et smart-phone avec Interface 3D



Imagerie médical et contrôle non destructif

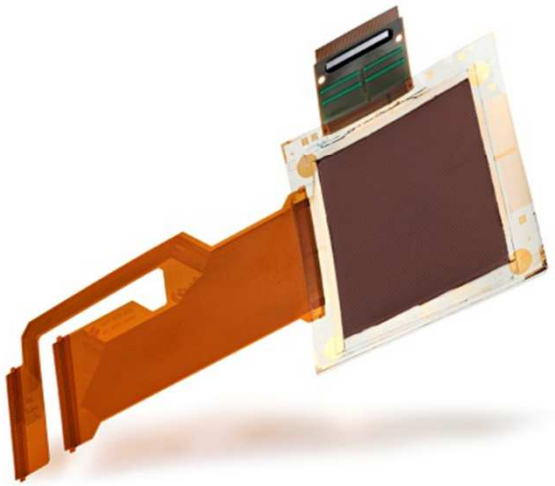
Exemples d’applications

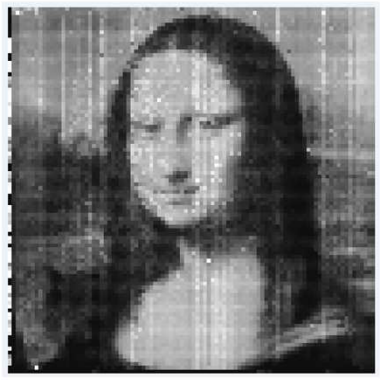
Electroménager



Contrôle industriel

Scanners

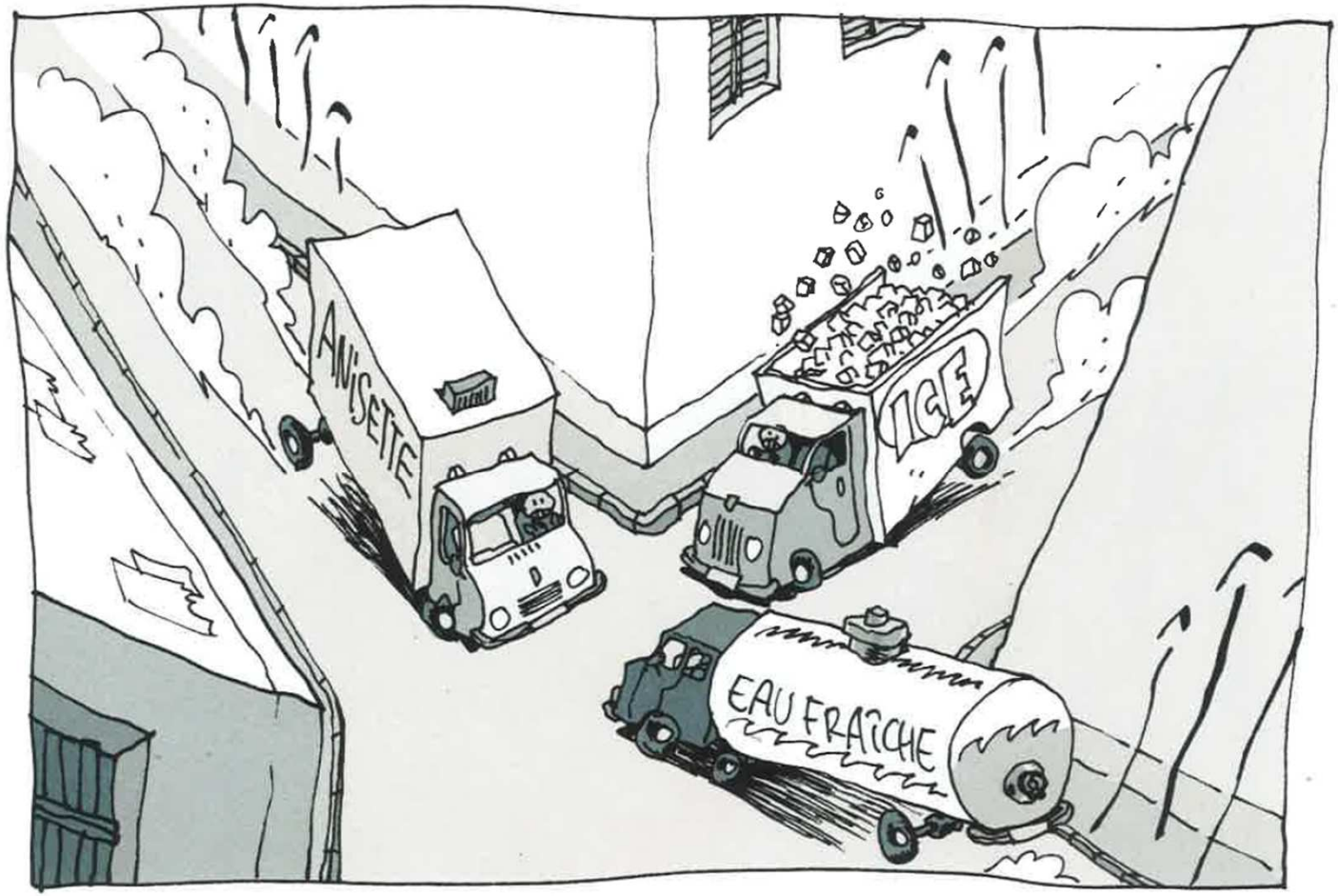




1er démonstration de scanner flexible tout imprimé

et bien d’autres applications à inventer…

Conclusions



DEUX SECONDES AVANT L'INVENTION DU PASTIS

Merci de votre attention