



BIRD'S EYE VIEW OF GRAPHENE

WHERE THE EU IS IN THIS PICTURE

Disruptive Technologies

personal computers

LCD, LED

mobile phones

"Disruptive Materials"

Silicon?

Teflon?

Plastics

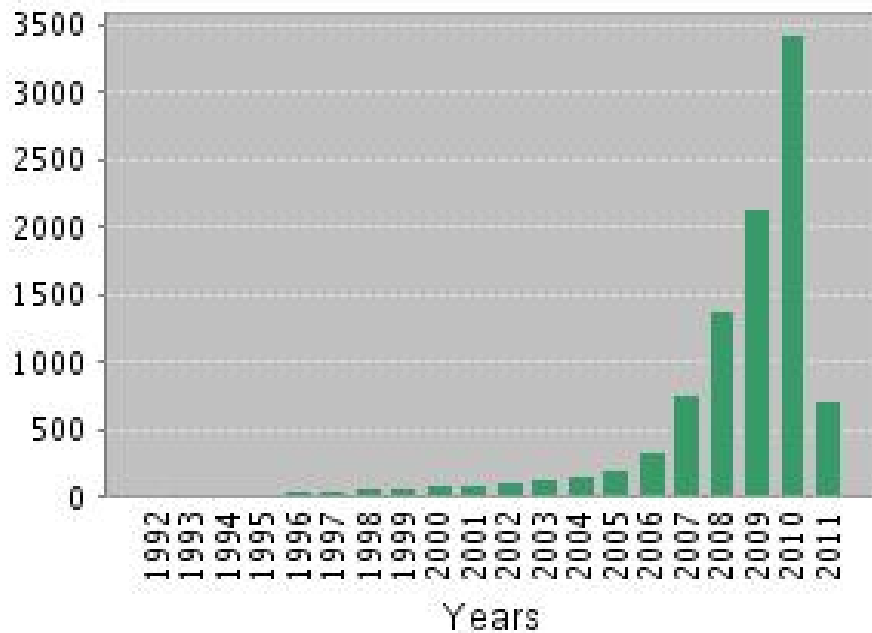
GRAPHENE!?

VERY DISRUPTIVE academically speaking

as of 2011 > 10,000 research papers

ISI Web of KnowledgeSM

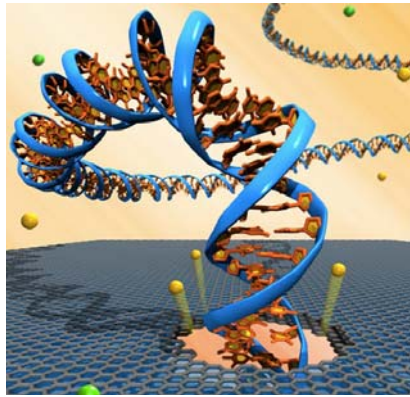
Published Items in Each Year



hundreds
if not thousands
academics moved

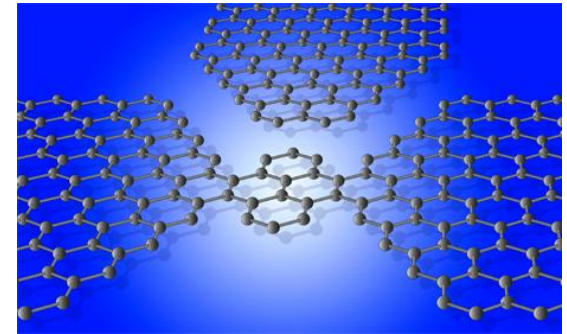
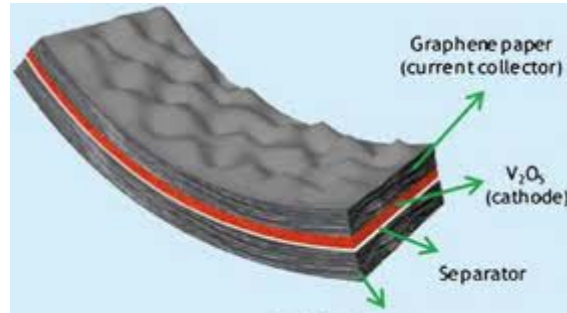
COSTS:
per paper ~€100,000
total of ~ €1B

5 Nobel laureates
active in the research



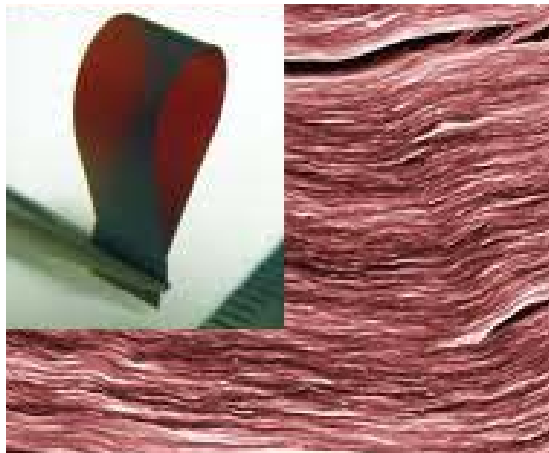
medical applications:
drug delivery;
lab-on-chip;
DNA sequencing

batteries; supercapacitors
conductive inks; etc.



graphene as next Si

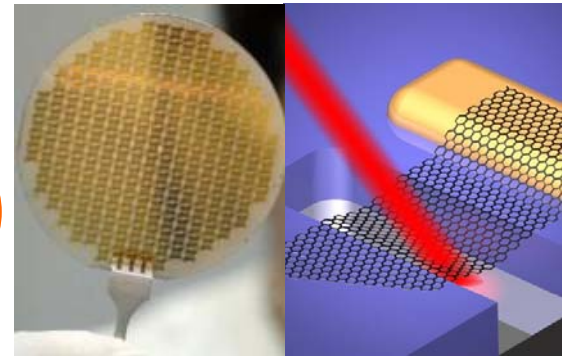
composites; barrier films



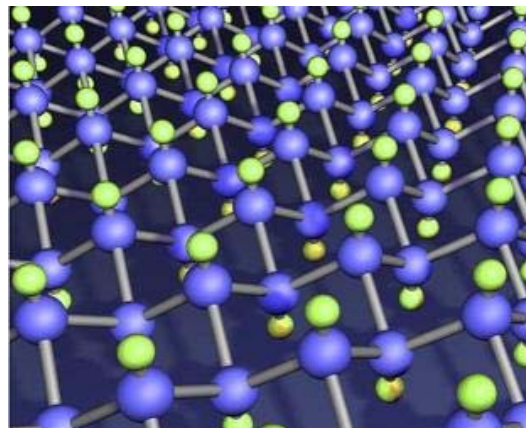
MEMS; various sensors



graphene applications



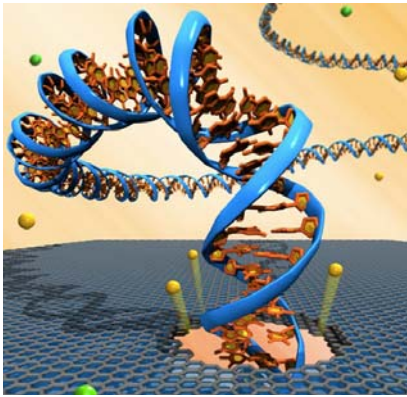
ultra-high frequency
electronics;
optoelectronics



graphene derivatives;
e.g., 2D analogue of Teflon

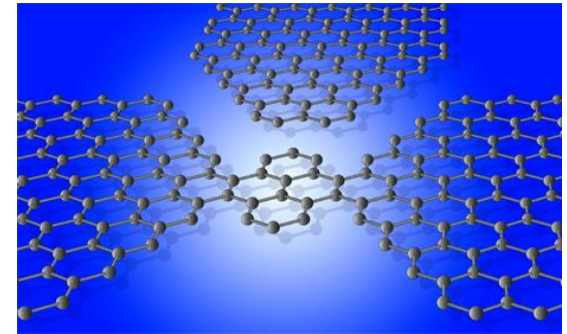
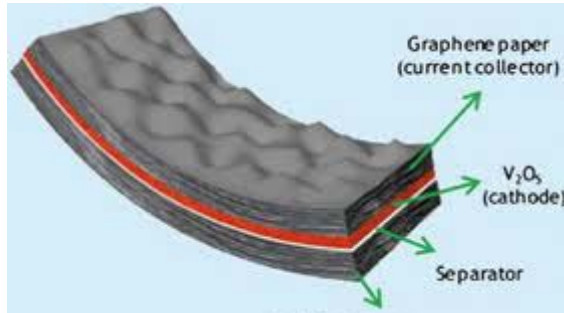


flexible
LCD and LED
wall lightning



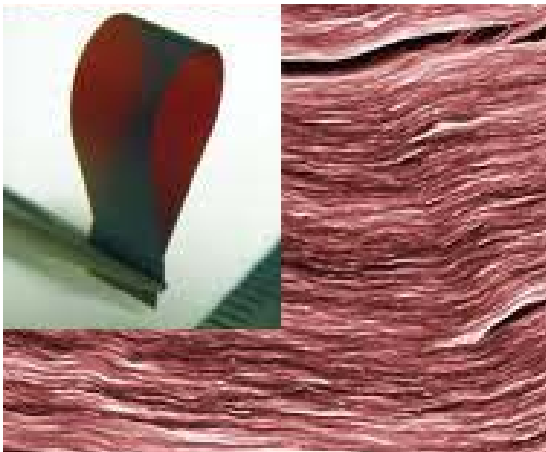
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graphene as next Si

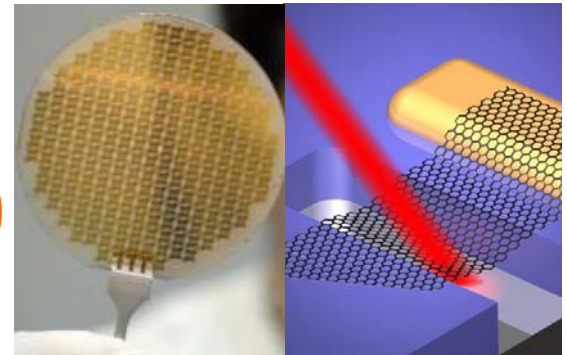
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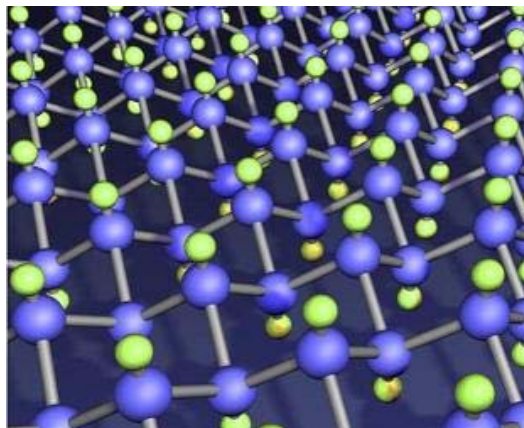
MEMS; various sensors



word graphene covers
many different materials
as word plastic does



ultra-high frequency
electronics;
optoelectronics



graphene derivatives;
e.g., 2D analogue of Teflon



flexible
LCD and LED
wall lightning

many small and VC companies



CVD



Harbin Mulan



MULTINATIONALS:



WHERE IS EUROPE?

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	Field: Institution Name	Record Count	% of 9154	Bar Chart
<input type="checkbox"/>	CHINESE ACAD SCI	346	3.7798 %	■
<input type="checkbox"/>	CSIC	216	2.3596 %	■
<input type="checkbox"/>	NATL UNIV SINGAPORE	191	2.0865 %	■
<input type="checkbox"/>	RUSSIAN ACAD SCI	171	1.8680 %	■
<input type="checkbox"/>	UNIV CALIF BERKELEY	168	1.8353 %	■
<input type="checkbox"/>	CNRS	144	1.5731 %	■
<input type="checkbox"/>	MIT	140	1.5294 %	■
<input type="checkbox"/>	TSINGHUA UNIV	134	1.4638 %	■
<input type="checkbox"/>	TOHOKU UNIV	128	1.3983 %	■
<input type="checkbox"/>	NANYANG TECHNOL UNIV	126	1.3764 %	■
<input type="checkbox"/>	UNIV TEXAS AUSTIN	125	1.3655 %	■
<input type="checkbox"/>	COLUMBIA UNIV	118	1.2891 %	■
<input type="checkbox"/>	TOKYO INST TECHNOL	110	1.2017 %	■
<input type="checkbox"/>	GEORGIA INST TECHNOL	107	1.1689 %	■
<input type="checkbox"/>	UNIV MANCHESTER	105	1.1470 %	■
<input type="checkbox"/>	UNIV MARYLAND	96	1.0487 %	■
<input type="checkbox"/>	UNIV TOKYO	95	1.0378 %	■
<input type="checkbox"/>	JAPAN SCI & TECHNOL AGCY	93	1.0159 %	■
<input type="checkbox"/>	NATL CHENG KUNG UNIV	89	0.9723 %	■
<input type="checkbox"/>	RADBOD UNIV NIJMEGEN	86	0.9395 %	■

← #15 MANCHESTER

← #20 NIJMEGEN

PATENT ON GRAPHENE

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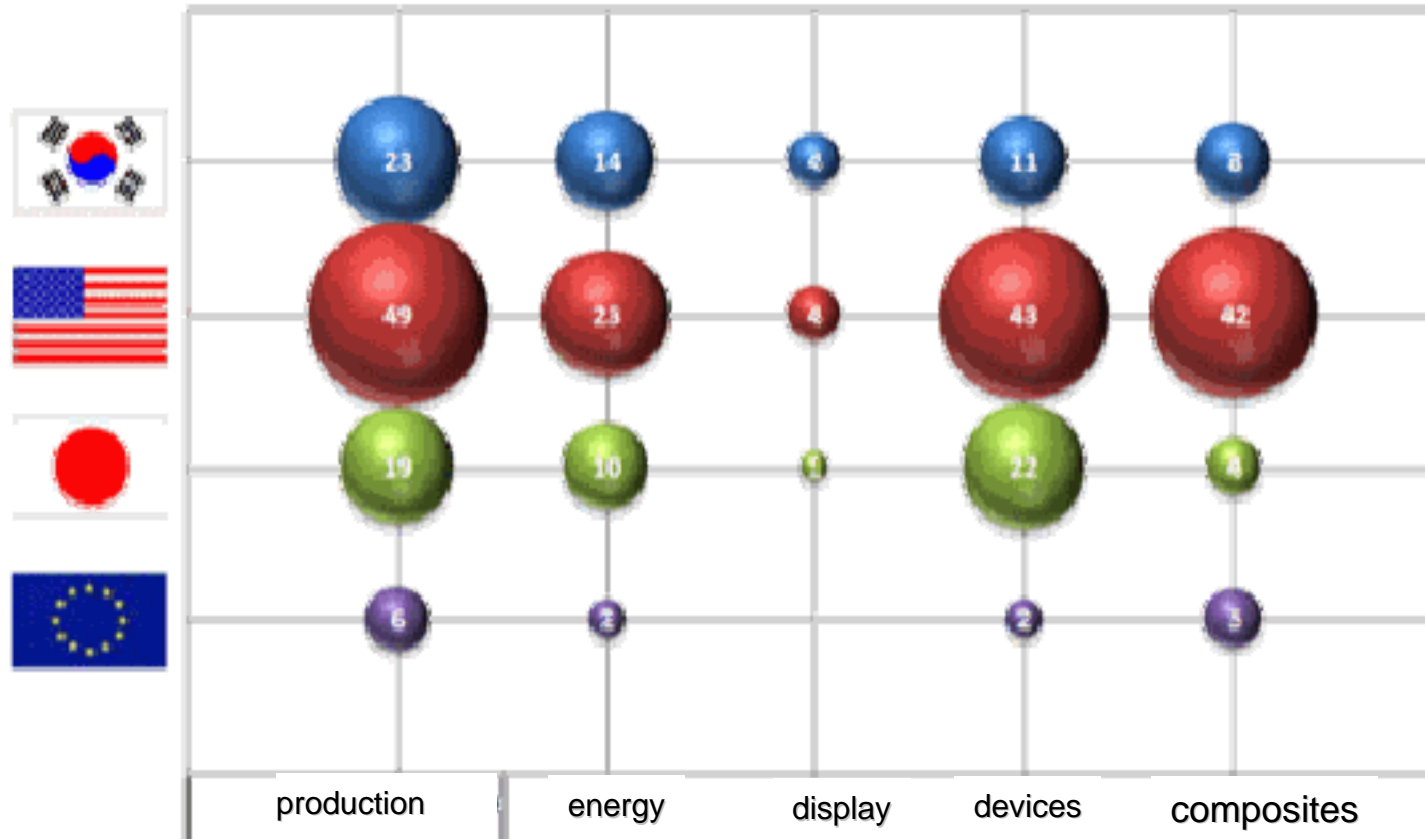
Field: Publication Year	Record Count	% of 590	Bar Chart
2010	321	54.4068 %	
2009	160	27.1186 %	
2008	50	8.4746 %	
2011	40	6.7797 %	
2007	19	3.2203 %	

Field: Publication Year	Record Count	% of 590	Bar Chart
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~ 600 graphene patents
more than half granted in 2010

PATENT ON GRAPHENE

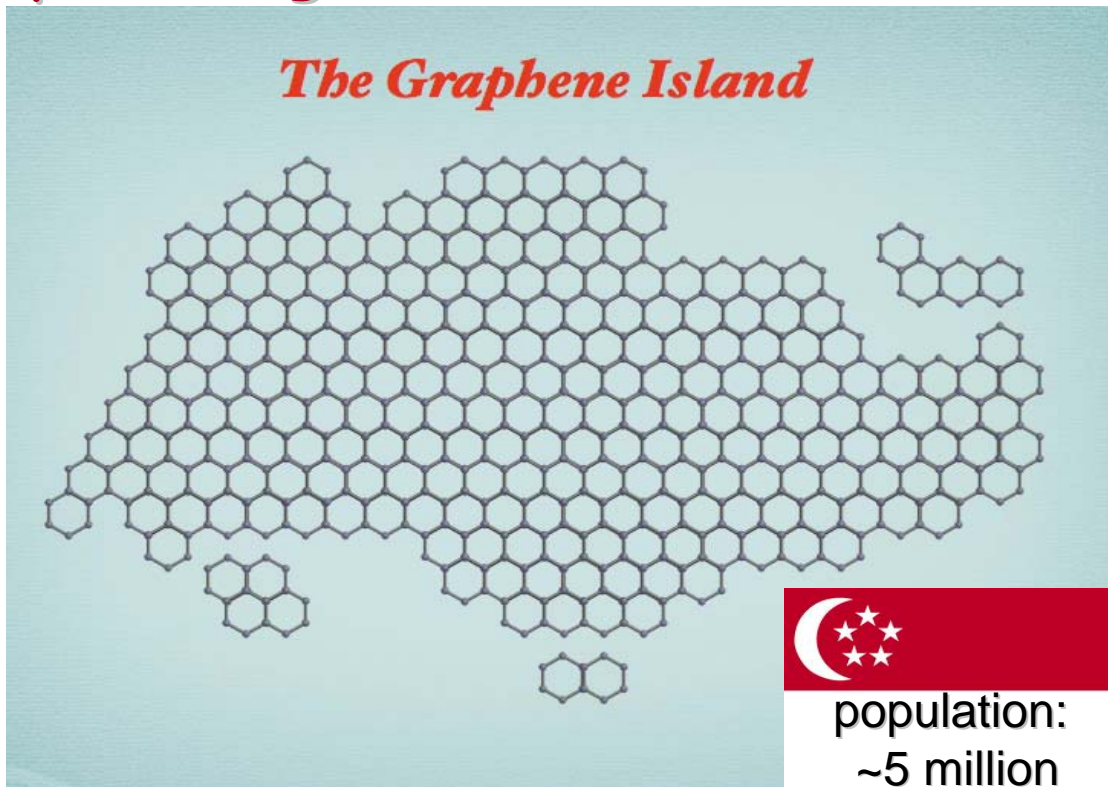
source: *Displaybank Feb 2011*



WHERE IS EUROPE?

MONEY, MONEY, MONEY ...

new grants @NUS in 2010: ~\$100M
poaching best EU researchers



AS IF:
G7 country
would spend
all physical &
engineering
sciences
budget
on graphene only



Korea (population ~50 million)
\$300M new graphene program
(Samsung)

AS IF:
EU would
spend all FP7
nuclear budget
on graphene



IS EUROPE DOOMED
TO BE LEFT FAR BEHIND?

IS THE EC CAPABLE
TO CHANGE THE THINGS
AND TAKE THE LEAD?

THE UK SITUATION

4 years ago:

"offers no industrial opportunities"

1 year ago:

"a big part of our portfolio
is already in graphene research"

THE EC SITUATION

this year:

"just one material; too narrow"