



GRAPHENE TURNS 20

Two decades of
Nanomaterial
Innovation

October 23, 2024 2pm to 4pm (UK time)

October 23
2024

1:30 PM to 3:35 PM
London - BST

On-line
in Zoom

PROGRAM

1:30 - 1:40 PM

Opening Ceremony
Valdirene Peressinotto
Gerdau Graphene
Terrance Barkan
The Graphene Council

1:40 - 2:00 PM

**Future Outlook for 2D
Materials Industry**
Prof. Kostya Novoselov
Nobel Winner

2:00 - 2:20 PM

**Brazilian Science
Contribution**
Prof. Dr Ado Jório
UFMG

2:20 - 2:35 PM

**Graphene and
ESG Agenda**
Prof. Dr Guilherme Lenz
ABCARB

2:35 - 2:50 PM

**Case Studies:
Gerdau Graphene
solutions at scale**
Valdirene Peressinotto
Gerdau Graphene

2:50 - 3:10 PM

**Graphene Advances
in History**
James Baker
Graphene at Manchester

3:10 - 3:30 PM

**Q&A From the Virtual
Audience**
All speakers

3:30 - 3:35 PM

Closing ceremony
Valdirene Peressinotto
Gerdau Graphene
Terrance Barkan
The Graphene Council

[REGISTER HERE](#)



Graphene and ESG agenda

Prof. Dr. Guilherme Lenz

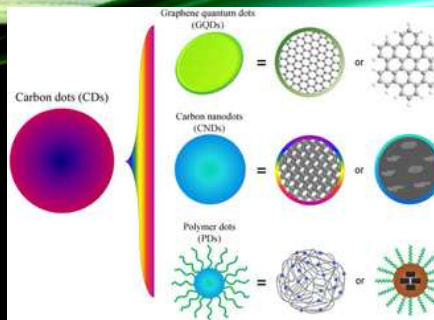
ABCARB – Brazilian Carbon Association

POLI - UNIVERSITY OF SÃO PAULO

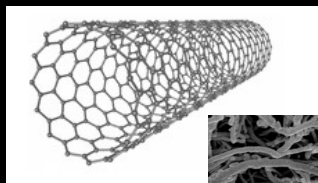
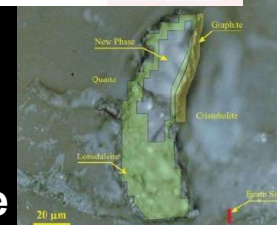
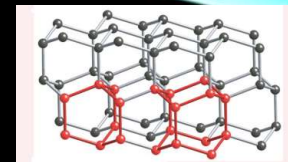
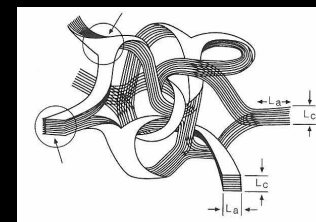
The carbon family !

John Dalton. 1808; (Symbol of Carbon) New System of Chemical Philosophy.

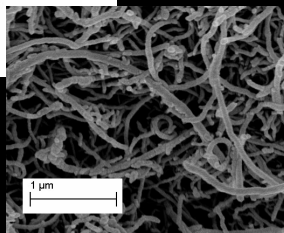
Antoine-Laurent Lavoisier, named the carbon element (C)



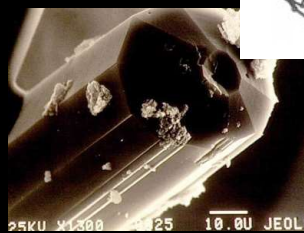
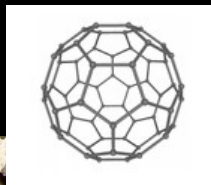
Amorphous & carbon black



CNT



SWCNT
DWCNT
MWCNT

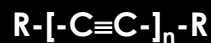


<http://www.cite-sciences.fr>

C₆₀, C₇₀, C₅₄₀, etc.

Fullerenes

Carbyns & carbolite



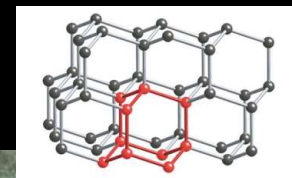
Carbon dots

Carbon Structures (Hybridization)

(Glassy Carbon Model - Jenkins G. M. and Kawamura, K. - 1976)

Lonsdaleite

Diamond

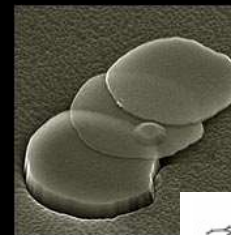


<http://www.nature.com>

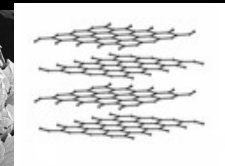
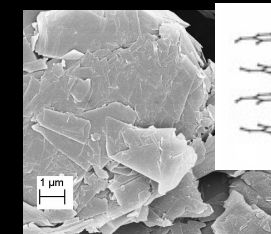
<http://www.musee.ensmp.fr>

Graphene, r-GO, FLG

Carbon cones & onions



Graphite



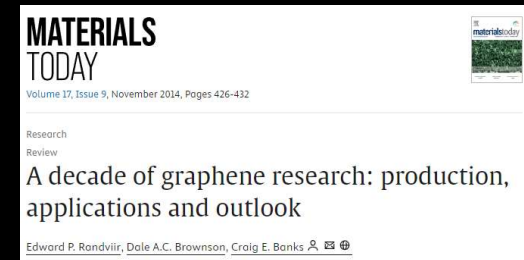
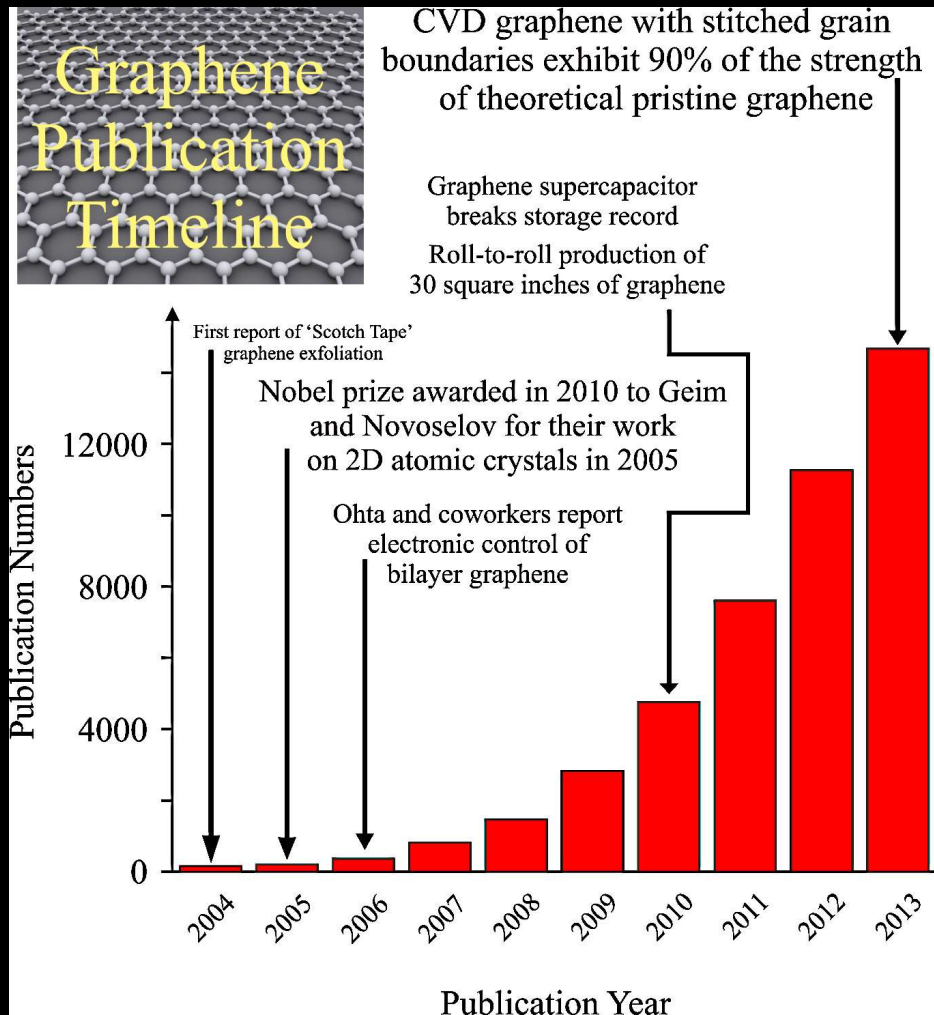
GRAPHENE TURNS 20 Two decades of Nanomaterial Innovation

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10 year ago ...

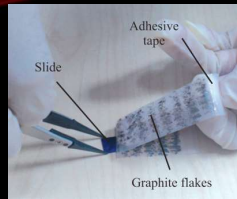
Applications:

- High speed electronics
- Data storage
- LCD smart windows and OLED displays
- Supercapacitors
- Solar cells
- Electrochemical sensing



<https://www.sciencedirect.com/science/article/pii/S1369702114002144>

Creativity,
Ingenuity,
Serendipity



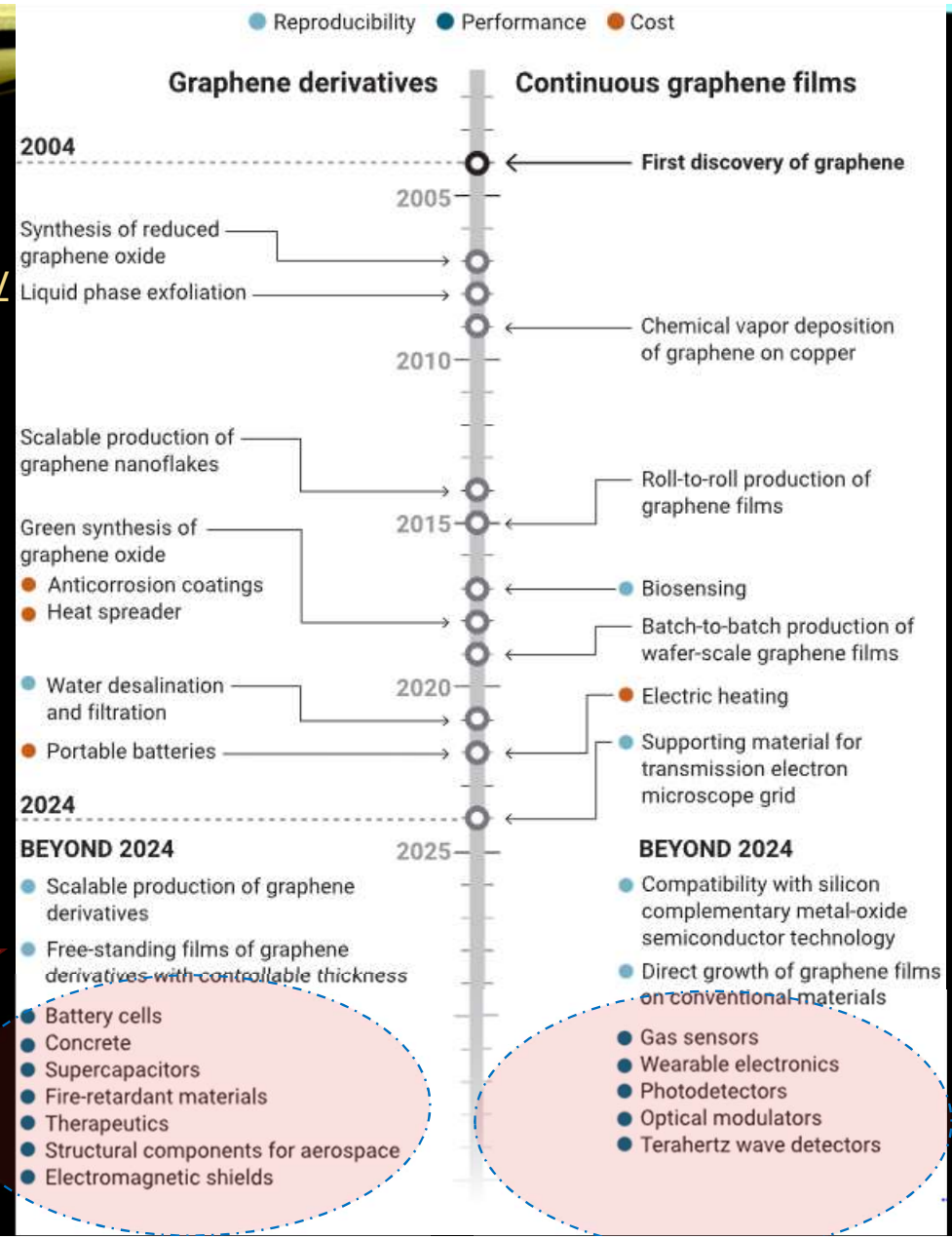
R. Van Noorden
Nature, 483 (2012), p. S32

~ 10 years of hard work on science & technology approach to scale up and industrial ramp-up !



New materials and increasing market share of graphene-based products ... ~20 years !

Wide range of new products compared 10 years ago !



Now ...

From lab to the market ...

- Universities
- Center of technology for industrial applications
- Spin offs
- Start ups
- New companies
- Big techs ...



<https://www.science.org/doi/10.1126/science.ads4149>



What changed ...

From lab to industry: **new products and new production capability** ! Lowering price ...new applications !

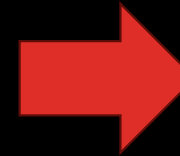
Understanding of graphene properties & applications ... “New graphene” material types/specifications

From pristine monolayers materials to dozen of “graphene family” materials ...mono, bi, last then 10 layers, more than 10 layers, nano graphite , oxidized graphite (many oxidation grades), GO, reduced GO, and so on !

<https://www.nature.com/articles/d41586-018-06939-4>



The screenshot shows a web page from the journal Nature. The header includes the 'nature' logo, a search bar, and a 'Log in' button. Below the header are navigation links: 'Explore content', 'About the journal', and 'Publish with us'. The main content area shows the breadcrumb 'nature > news & views > article', the date 'NEWS AND VIEWS | 08 October 2018', and the title 'The war on fake graphene'. The article's abstract reads: 'The material graphene has a vast number of potential applications – but a survey of commercially available graphene samples reveals that research could be undermined by the poor quality of the available material.' The author is listed as 'By Peter Baggett'. At the bottom of the article are social media icons for Twitter, Facebook, and Email.



The screenshot shows a video player interface. The video title is 'The Graphene Classification Framework'. The video player controls at the bottom show a progress bar at 0:02 / 38:15 and a play button. The video content area displays a dark background with a white hexagonal grid pattern and the title text.



The image shows two logos side-by-side. On the left is the 'ABCarb' logo, which consists of several interconnected hexagons in yellow, green, and blue. On the right is the 'GERDAU GRAPHENE' logo, which features a circular icon with a stylized 'G' and the text 'GERDAU GRAPHENE' below it. To the right of this logo is the text 'GRAPHENE TURNS 20' in large, bold letters, followed by 'Two decades of Nanomaterial Innovation' in smaller text. At the bottom of this section, it says 'October 23, 2024 7pm to 4pm (UK time)'.

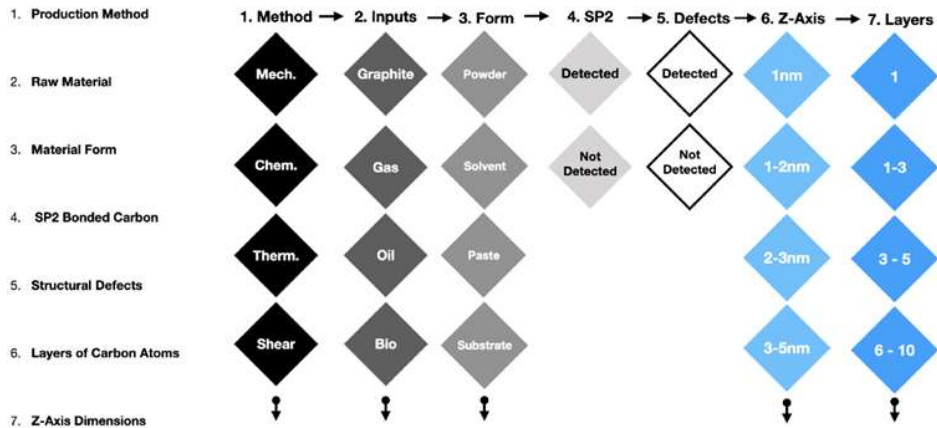


The Graphene Council

Research, Development and Application



Graphene Classification Framework

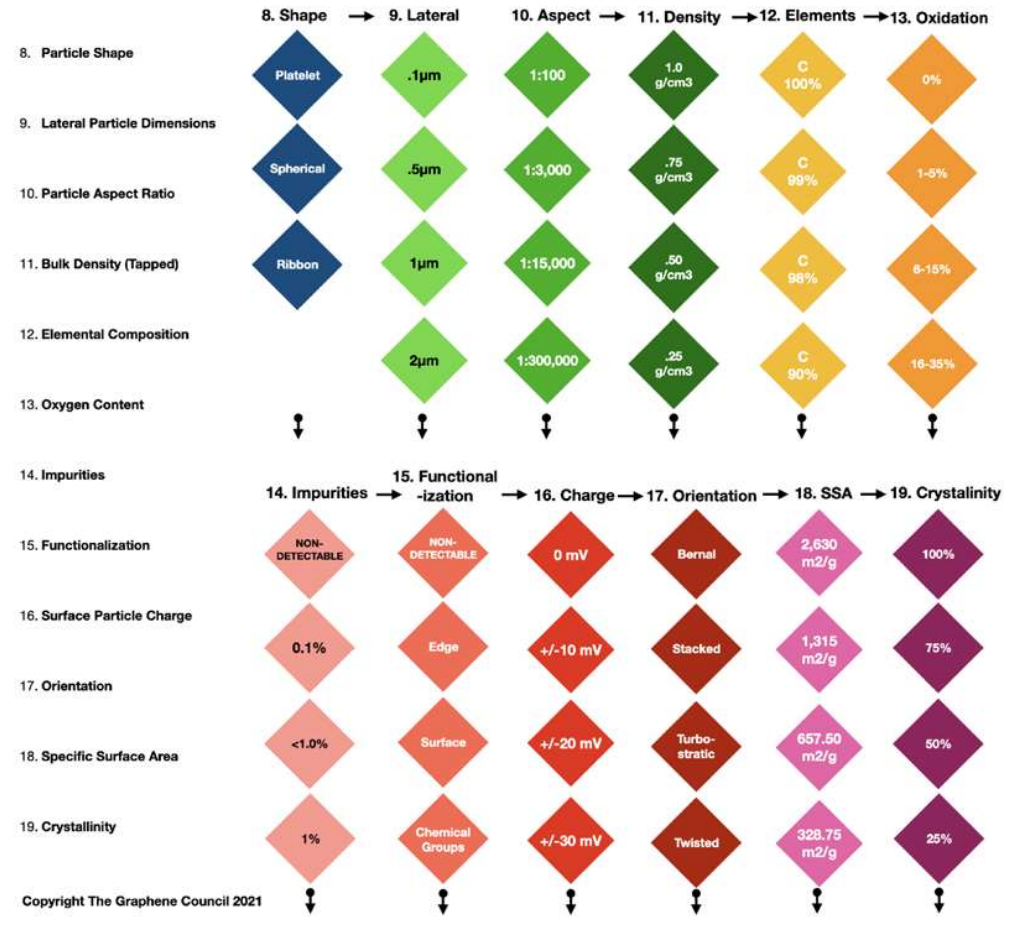


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The Graphene Council

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www.thegraphenecouncil.org

chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.ymaws.com/www.thegraphenecouncil.org/resource/resmgr/standards/report/gcf_public_version0.1.pdf



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MORE COMPLEX SYSTEM (WORLD), NEW
TOOLS AND SKILLED PEOPLE ...

IDEA'S ... START-UP'S ... SPIN-OFF'S ... MARKET
& BUSSINESS



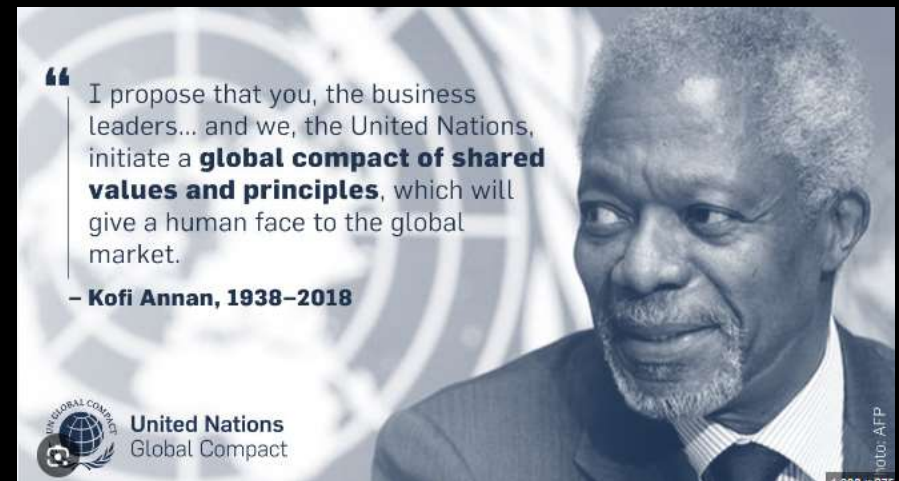
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ESG : ENVIRONMENTAL, SOCIAL & GOVERNANCE

ESG is a 20 years old concept !

It's came from UN (Kofi Annan UN secretary general)



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2004 report titled "Who Cares Wins",

ESG GIVE TO THE BUSINESS:

- CLEAR PURPOSES
- LONG TERM VISION
- INTREGRATED VISION
- VISIBILITY



People & Community

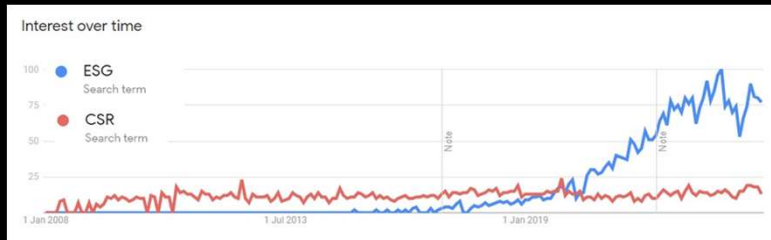


Planet



Business performance

COMPANIES THAT PERFORM BETTER WITH REGARD TO THESE ISSUES CAN INCREASE SHAREHOLDER VALUE



ESG: Environmental, Social & Governance
CSR: Corporate Social Responsibility



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Financial Sector
Initiative
Who Cares Wins

Graphical summary of key recommendations

Overall goals:

- Stronger and more resilient financial markets
- Contribution to sustainable development
- Awareness and mutual understanding of involved stakeholders
- Improved trust in financial institutions



S - Social

- Race/Colour Diversity
- Women in Management
- Inclusion
- Health
- Equity
- Training
- Safety
- Inequality



G - Governance

- Government/Regulation
- Corporate Governance
- ESG Investments
- Innovation
- Compliance
- Risk Management
- Accountability

E - Environmental

- Environmental Education and Carbon Market
- Reforestation
- Renewable Energies
- Decarbonization
- Climate Effects
- Recycling
- Environmental Preservation
- Energy Efficiency

THE BALANCE BETWEEN E & S. THE KEY POINT OF G!

Remember ... ESG came from a vision of UN working together of most influential finance companies, bank and market people, such like: [ABN AMRO Bank N.V.](#), [AXA](#), [Banco do Brasil](#), [Sarasin & Partners LLP](#), [BNP Paribas](#), [Credit Suisse](#), [Deutsche Bank](#), [Goldman Sachs](#), [HSBC](#), [Morgan Stanley](#), [UBS](#) and [Westpac](#) with more than 500 representatives from business and civil society !

Governance is the key point to evaluate, control and give vision and directions for the ESG platform. It is the balance for a good implementation of **S (Social)** and **E (Environmental)** programs based on accountability, performance, measurements, goals and achievements !

Without metrics and vision, it is impossible to implement a coherent ESG program!





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<https://www.un.org/sustainabledevelopment/news/communications-material/>



New plastic composites: high mechanical properties, less material use, recycling technologies based on graphene materials: chemical adsorbents for metal recovery



New electronic materials: Sensors, resistive memories, smart screens, etc.



New medical treatments: graphene-based scaffolds (bone replacement with stem cell technology, graphene tissue engineering, Soft 3D printed human tissue, etc.



New materials: OPC (ordinary Portland cement) with graphene

New companies, tech business, new products, new materials & Applications



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High efficiency membranes for water filtration and treatment



Graphene for wind blades composites
Graphene based solar cells
(...)

Low carbon footprint technologies: solar cells, New batteries, carbon capture & storage, Synthetic photosynthesis, ...



Graphene for pollutants removing & treatment, soil fertilizing, ...



Water pollution control technologies



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And here ? ... It is about good
Leadership & Vision !

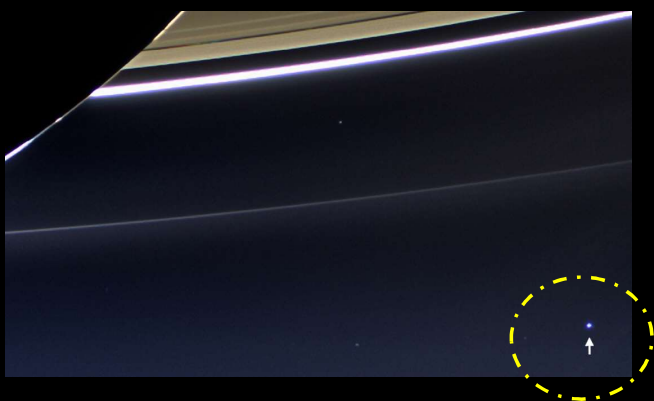
... Simple like that !!!!!

Communication
Ethics
Responsibility
Empathy
Actions
Integrity



There is only one Earth ! ...

You should know by now ... There is no plan B !



2013: Earth as seen through Saturn's rings (Cassini)

Image Credit: NASA/JPL-Caltech/Space Science Institute

Earth as seen from Saturn's rings looks like a blue luminescent carbon dot !!!

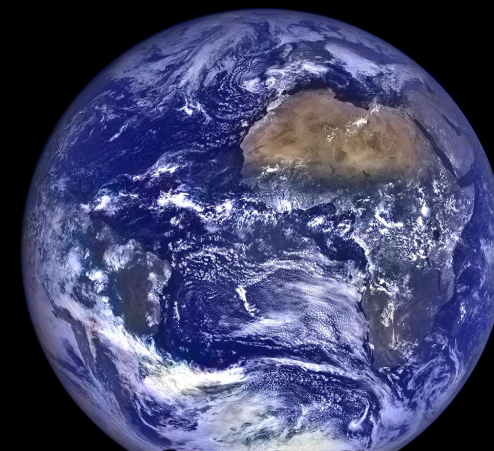


Image Credit: NASA/Goddard/Arizona State University

2015: Earthrise 2.0 (Lunar Reconnaissance Orbiter)



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<https://explorer1.jpl.nasa.gov/galleries/earth-from-space/>



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Thanks

धन्यवाद

Aloha

Merci

Gracias

谢谢

Danke

Grazie

Teşekkürler

Dziękuję

Спасибо (*Spasibo*)

Obrigado

Brazilian Carbon Association / ABCARB – President
Senior Member of AIChE – American Institute of Chemical Engineers
Strategic Decision and Risk Management Certificate Professional (Stanford University)
Visiting Scholar at Brown University (LEHN / School of Engineering)
Academic Visitor at Imperial College London (Department of Materials)
Postdoctoral Fellow at the University of Sheffield/UK (Department of Materials Science & Engineering)
Ph.D in Materials and Metallurgical Engineering from University of São Paulo (USP)
MBA in Environment Technologies & Management from Polytechnic School of Engineering (POLI-USP)
Certified Safety Professional from Federal University of Minas Gerais (UFMG)
Metallurgical Engineer from Federal University of Minas Gerais (UFMG)

Let's talk with us about carbon !
<https://abcarb.org.br/>



Education changes people
People change the world !



ANNEX

Safety aspects

Chapter

Risk Assessment and Health, Safety, and Environmental Management of Carbon Nanomaterials

Guilherme Lenz e Silva, Camila Viana, Danieli Domingues and Fernanda Vieira

<https://www.intechopen.com/chapters/66689>

Graphene
Bilayer graphene
Few layers ...

...

Nanographite



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NIOSH, ISO
OECD, BSI
HSE, IEST, CSA ...

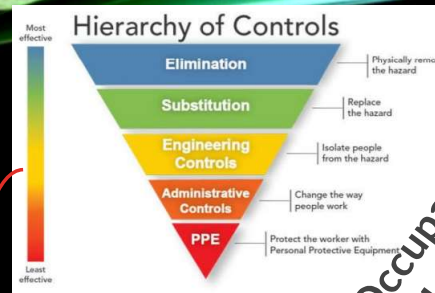


Nanotechnology & Nanomaterials

New industry

Understanding
Interpretation
Evaluation
New methodologies
Adaptation
Interconnection
Legislation
(soft and hard law)
....

Identifier:	E3059
Document Title:	Standard Guide for Workforce Education in Nanotechnology Infrastructure
Identifier:	12901-2
Document Title:	Nanotechnologies – Occupational risk management applied to engineered nanomaterials – Part 2: Use of the control banding approach
Identifier:	12901-1
Document Title:	Nanotechnologies — Occupational risk management applied to engineered nanomaterials - Part 1: Principles and approaches
Identifier:	DHHS (NIOSH) 2012-147
Document Title:	General Safe Practices for Working with Engineered Nanomaterials in Research Laboratories



"old" industry

ISO 45001:2017 Occupational Health and Safety Management System (Dec)

BS OHSAS 18001

ISO 14001:2015 Environmental Management

ISO 9001:2015

Quality, health, safety and environmental management systems



Hazards identification & OH&S risks



Risks: identification, evaluation and control



Environmental aspects



Products requirements