

**وبینار علمی «تکنولوژی های جدید در صنایع نفت، گاز و پتروشیمی»
«بخش اول»**

با مشارکت دانشگاه صنعتی امیر کبیر،

یکشنبه ۱۴ اردیبهشت ۱۳۹۹



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



COVID-19 coronavirus epidemic has a natural origin



Date: March 17, 2020

Source: Scripps Research Institute

Credit: © pinkeyes / [Adobe Stock](#)

Summary: An analysis of public genome sequence data from SARS-CoV-2 and related viruses found no evidence that the virus was made in a laboratory or otherwise engineered.

Source: <https://www.sciencedaily.com/releases/2020/03/200317175442.htm>

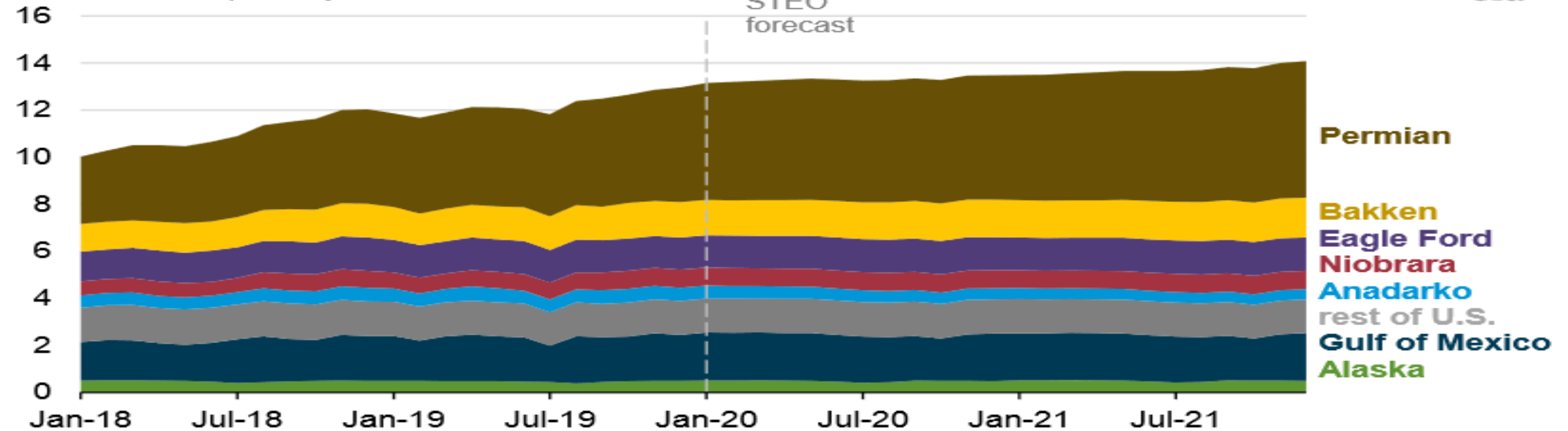
U.S. Oil Production



EIA forecasts U.S. crude oil production will keep growing through 2021, but more slowly

Monthly U.S. crude oil production by region (Jan 2018-Dec 2021)

million barrels per day

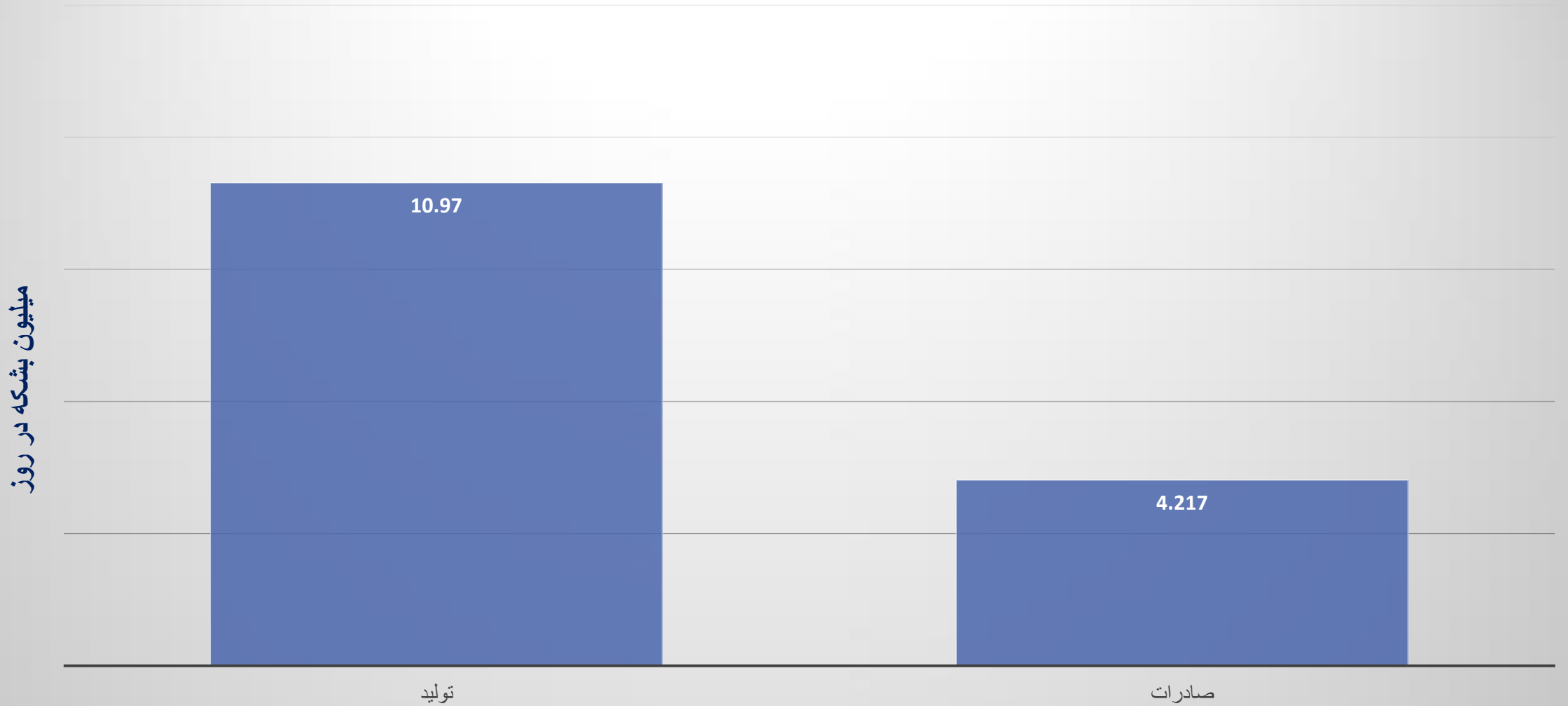


Source: U.S. Energy Information Administration, *Short-Term Energy Outlook*, January 2020

- U.S. oil production is expected to average 13.3 million barrels per day (mb/d) in 2020, an increase of 9 percent from last year, according to the [EIA](#). The agency sees output averaging 13.7 mb/d in 2021.
- The agency expects the rig count to continue to decline through most of 2020. But improved rig efficiency means that output could continue to climb, albeit at a slower rate.
- The EIA sees the Permian averaging 5.2 mb/d this year, up 0.8 mb/d from 2019.



تولید و صادرات نفت روسیه در ماه مه سال ۲۰۱۸



OIL AND NATURAL GAS PRICES *(as of 10:30 AM CT 01/17/20)*

	Price	Change	%Change	Contract
WTI	58.59	+0.06	+0.10%	FEB 2020
Brent	64.70	+0.08	+0.12%	MAR 2020
Natural Gas (Nymex)	1.989	-0.057	-2.79%	FEB 2020

WEEKLY U.S. OIL PRODUCTION *(million barrels per day)*

	Change from previous week	01/10/20	01/03/20	12/27/19	12/20/19	12/13/19	12/06/19
U.S. production	+0.100	13.000	12.900	12.900	12.900	12.800	12.800

West Africa loses if China buys more U.S. oil and gas.

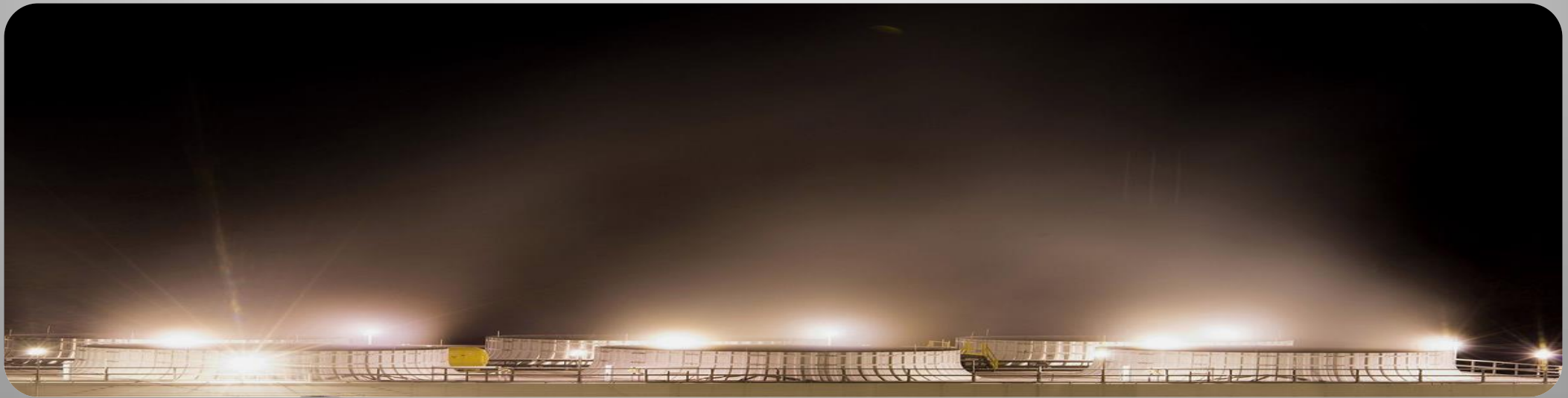
The Phase 1 trade deal calls for China to buy huge volumes of U.S. oil and gas, although analysts question whether such increases are possible. **China has pledged to buy more than \$52 billion in energy products from the U.S. over the next two years.** Such an increase would have ripple effects throughout the global market, with West African exporters losing out as China scoops up more cargoes from the U.S.

OilPrice Intel <mscott@oilprice.com>

Impact of Shale Oil on the Market

- ***Benchmark North Sea Brent crude oil spot prices averaged \$46 per barrel (b) in June, a \$4/b decrease from the May average and the lowest monthly average since November of last year when prices averaged \$45/b.***
- ***Brent crude oil prices are forecast to average \$51/b in 2017 and \$52/b in 2018, \$2/b and \$4/b lower than projected in last month's STEO, respectively.. Source: EIA***

America Is Awash With Natural Gas and It's About to Get Worse



Water vapor rises from cooling towers at the Appalachian Power Co. natural gas plant in Dresden, Ohio, U.S. Photographer: Ty Wright/Bloomberg

Trump spoke at an industry event of the “astonishing increase” in shale gas production. Prices dipped briefly below \$2 per million British thermal units on Friday for the first time since 2016 and traded below the threshold again on Monday.

Source; Bloomberg, January 20, 2020

Gas Deflation

Prices on Jan. 17 dipped below \$2 for the first time since 2016

■ U.S. natural gas futures



Source: Nymex

Mansour daftarian - 14/2/1399

Bloomberg

Fracking to the Top

The U.S. is now the world's biggest gas producer



Source: BP Statistical Review

Mansour daftarian - 14/2/1399

Trump's 2 sentences on energy



"We have ended the war on American energy — and we have ended the war on clean coal. We are now an exporter of energy to the world," Trump said, adding that his administration has "eliminated more regulations in our first year than any administration in history." Source: E&E News eaalerts@eenews.net - Wed 1/31/2018 3:42 PM

بررسیهای انجام شده نشان میدهد که طی چند دهه اخیر عمدتاً به دلیل فقدان فرهنگ دانش پژوهی و پویایی در مهندسين فارغ التحصيل کشور و در نتیجه عدم آشنایی بدنه فنی به فناوری های روز که بعضاً بصورت چشمگیر در حال تغییر و ارتقاء میباشد، اقتصاد کشور در بخشهای مدیریت مصرف انرژی، کلیه صنایع (بخصوص صنایع تولید کننده سیستمهای انرژی بر و صنایع پتروشیمی) و در مخازن مشترک نفت و گاز با زیانهای فزاینده مواجهه میباشد.

انجمن مهندسی گاز ایران از سال ۱۳۹۳ ارتقاء توانمندی بدنه فنی / اقتصادی کشور را: (۱) از طریق ارائه پیشنهاد ایجاد سیاستگزاری جدید در دانشگاه ها با هدف ارتقاء سطح آموزش و (۲) از طریق کارفرمایان عمده با ارائه پیشنهاد برنامه ریزیهای نوین نیروی انسانی و آموزش حین کار پیگیری مینماید.

زمینه سازی با هدف توسعه جهانی شدن،

سیاستگذاری انگیزشی با هدف تسلط کامل پرسنل فنی به زبان انگلیسی و روشهای تحقیق،

پایش مستمر و به روز رسانی برنامه نیروی انسانی شایستگان در دیسپلین های مختلف،

برنامه ریزی آموزشی خارج از کشور و داخلی تخصصی و مدیریتی شایستگان

برگزاری نشست ها و سمینارهای تخصصی ششماهه در دیسپلین های مطرح،



Statistics

BP statistics, June 2018

Proved Oil Reserves ,in Billion Barrels:

1. Venezuela : 303.2
2. Saudi Arabia: 266.2
3. Canada: 168.9
4. Iran: 157.2

Proved Natural Gas Reserves, in Trillion Cubic Meters, TCM:

1. Russia: 35
2. Iran: 33.2
3. Qatar: 24.9
4. Turkmenistan:19.5
5. USA: 8.7
6. Saudi Arabia: 8

Combined Oil and Gas Proved Reserves, in Billion barrels Oil Equivalent:

1. Iran: 376.32
2. Venezuela: 345.44
3. Russia: 337.2
4. Saudi Arabia:319

Natural Gas Production in 2017, in Billion Cubic Meters, bcm:

1. USA: 734.5
2. Russia: 635.6
3. Iran:223.9
4. Canada: 176.3
5. Qatar; 175.7

Natural Gas Consumption in 2017, in Billion Cubic Meters, bcm:

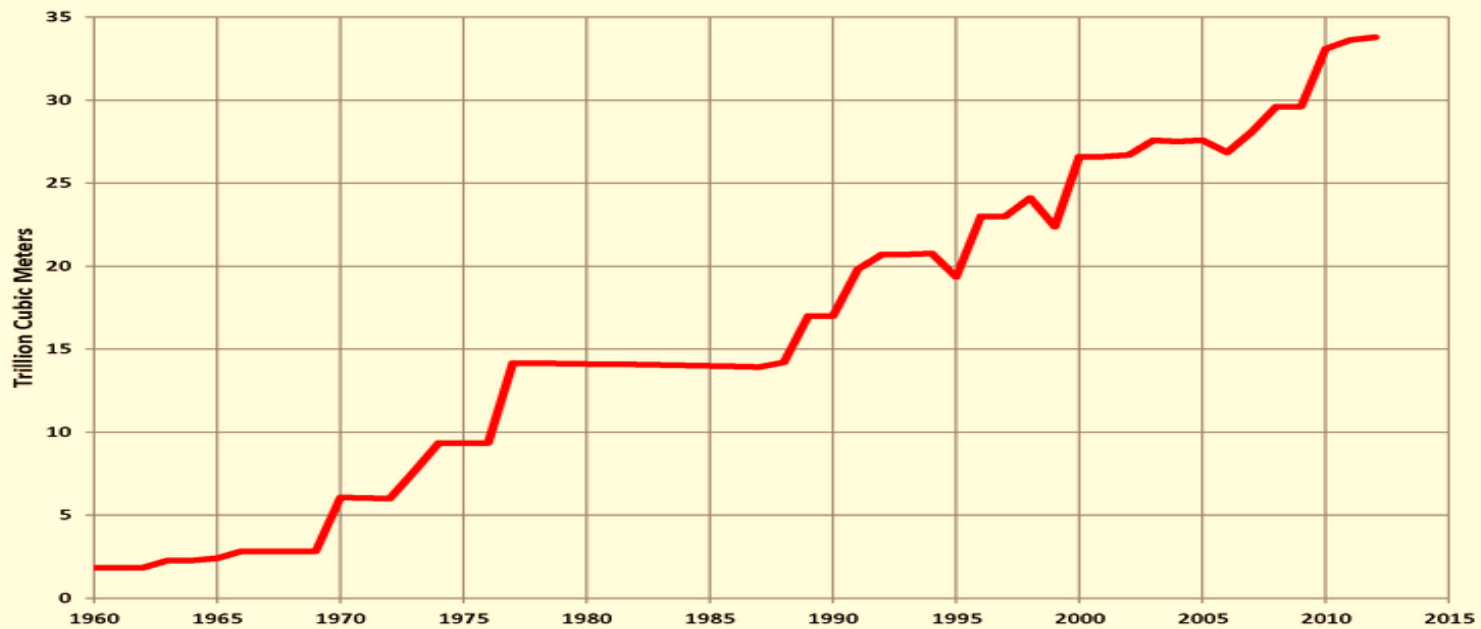
1. USA: 739.5
2. Russia: 424.8
3. China:240.4
4. Iran: 214.4

Proved Natural Gas Reserves in Iran

The US Energy Information Administration estimated Iran's proved gas reserves as of the start of 2013 as 1,187 trillion cubic feet (33.6 trillion cubic meters), rendering it 1st the world, surpassing Russia's. This is equivalent of about 216 billion barrels of oil.

https://en.wikipedia.org/wiki/Natural_gas_reserves_in_Iran

18



- ▶ Iran's proven mineral reserves total 50 billion tons
- ▶ discoveries carried out over the past few years had led to a significant increase in Iran's proven mineral wealth which includes at least 60 different minerals.



SOURCE: [HTTPS://WWW.MSN.COM/EN-XL/MIDDLEEAST/MIDDLEEAST-TOP-STORIES/IRANS-PROVEN-MINERAL-RESERVES-TOTAL-50-BILLION-TONS-MINISTER/AR-BBZX0Z8?LIH=1&OCIA=1&from=3140201399](https://www.msn.com/en-xl/middleeast/middleeast-top-stories/irans-proven-mineral-reserves-total-50-billion-tons-minister/ar-BBZX0Z8?LIH=1&OCIA=1&from=3140201399)

۷۲ درصد کسری در آمد شاغلان در ایران



❑ خبرگزاری "مهر" در گزارشی مشروحی در آمد حداقل افراد مجرد در سال گذشته را ۷۳۰ هزار تومان اعلام کرد و افزود که در آمد ماهانه افراد متأهل دارای یک فرزند ۷۸۵ هزار تومان و افراد متأهل دارای دو فرزند ۸۴۵ هزار تومان بوده است.

❑ بر اساس مصوبه شورای عالی کار، در آمد حداقل یک فرد مجرد برای سال جدید ۸۹۲ هزار تومان، شاغلان متأهل دارای یک فرزند ۹۶۳ هزار تومان و شاغلان دارای دو فرزند یک میلیون و ۳۵ هزار تومان تعیین شده است.

Norway's oil fund hits \$1000,000,000,000 in value

Norway's sovereign wealth fund, popularly known as the oil fund, has this week reached a staggering value of one trillion U.S. dollars (\$1,000,000,000,000) for the first time.

The world's largest sovereign wealth fund got its first capital in 1996 when the oil revenue from the government was transferred to the fund for the first time. The mission of the fund to bring financial wealth for future generations of Norwegians once the oil revenues declines.

As said on the fund's website: "The Government Pension Fund Global is saving for future generations in Norway. One day the oil will run out, but the return on the fund will continue to benefit the Norwegian population."

Managed by the country's central bank, the fund invests in thousands of companies and industries around the world, all outside Norway.

ذخایر نفت - ۲۰۱۷

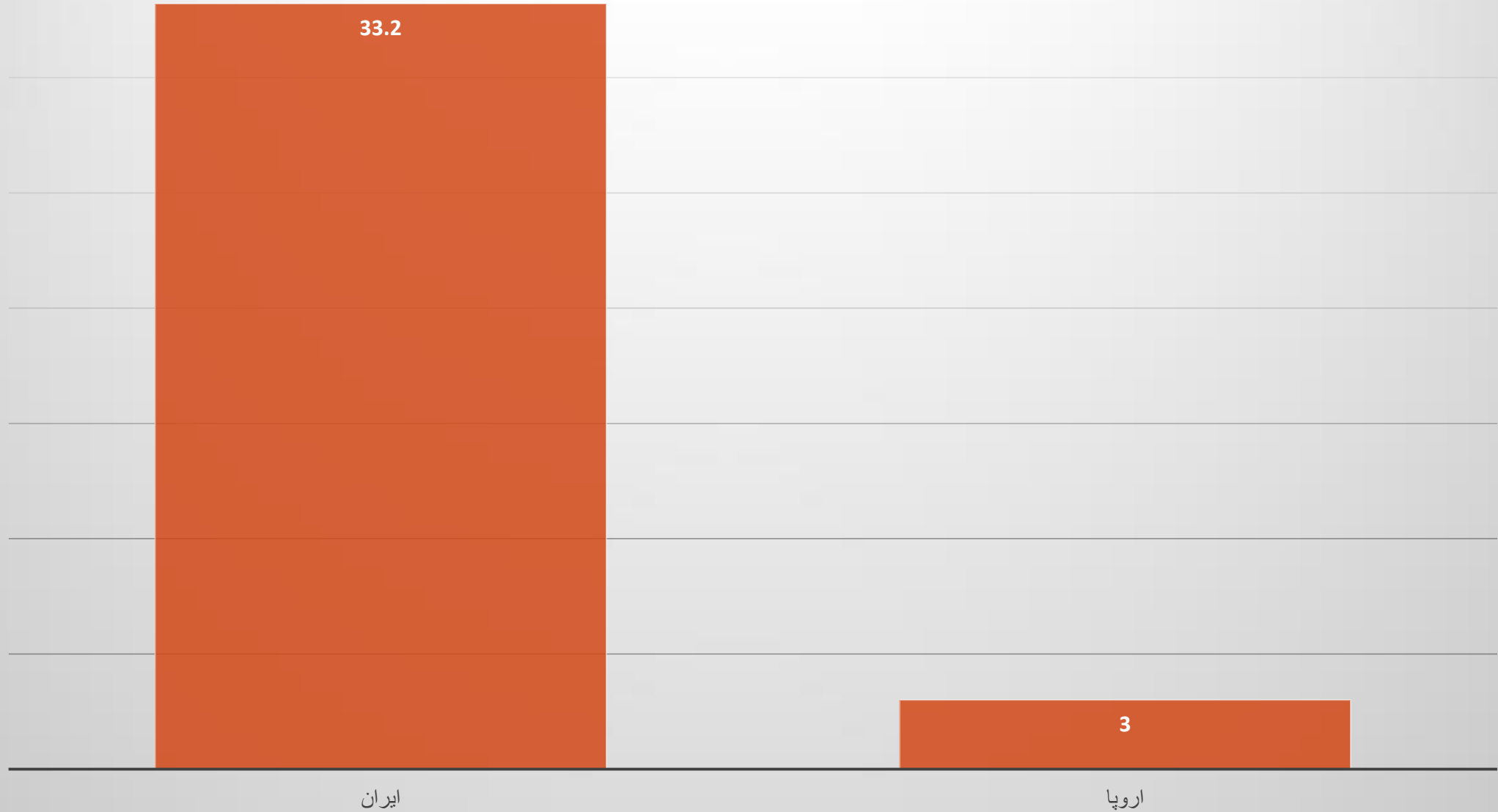
میلیارد بشکه



Source : BP

ذخایر گاز طبیعی - ۲۰۱۷

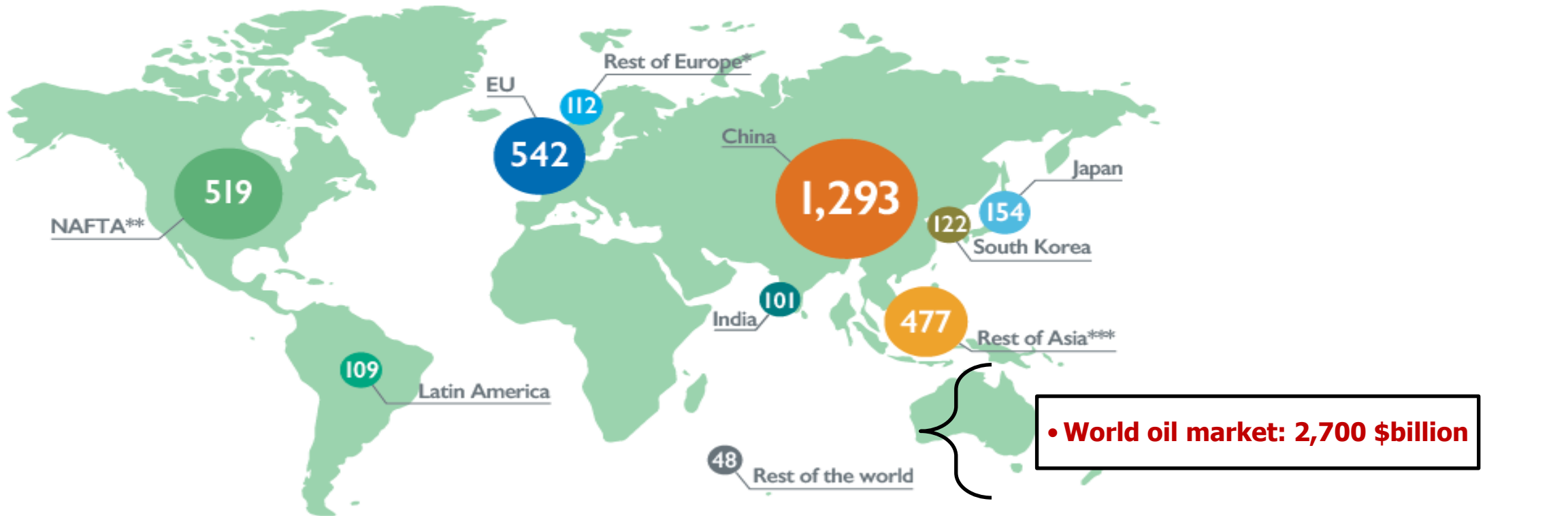
تریلیون متر مکعب



Europe is the second largest chemicals producer in the world

World chemical sales (€3,475 billion)

EU: 608 billion USD



• World oil market: 2,700 \$billion

• World chemical market: 3,857 \$billion

Source: Cefic Chemdata International 2018
* Rest of Europe covers Switzerland, Norway, Turkey, Russia and Ukraine
** North American Free Trade Agreement
*** Asia excluding China, India, Japan and South Korea

Unless specified, chemical industry excludes pharmaceuticals
Unless specified, EU refers to EU 28

EU Chemical Industry

- The chemicals industry is one of Europe's largest manufacturing sectors. As an 'enabling industry', it plays a pivotal role in providing innovative materials and technological solutions to support Europe's industrial competitiveness.*
- The chemicals industry produces petrochemicals, polymers, basic inorganics, specialties, and consumer chemicals.*
- has sales amounting to EUR 542 billion (2017), which is about 16% of global chemicals sales.*

provides 1.14 million direct highly-skilled jobs (2016);

secures three times more jobs in other industries through indirect employment.

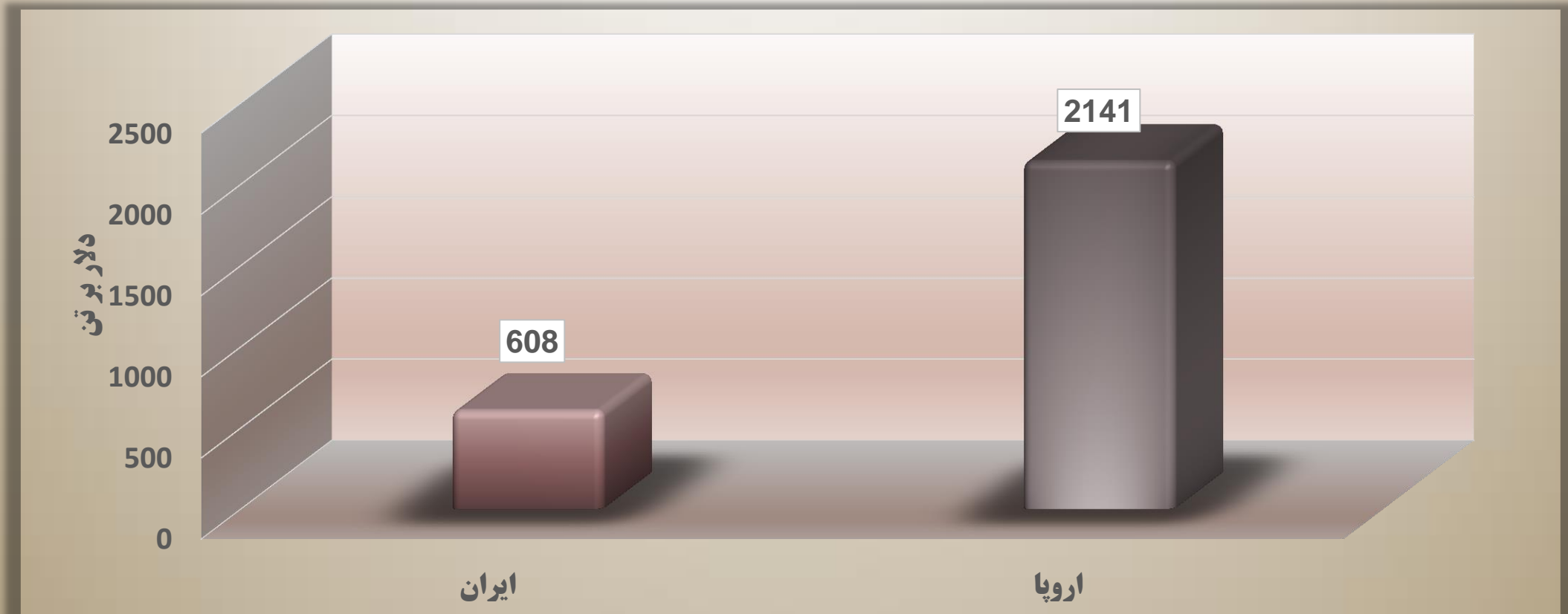


Global Petrochemical Market

- **Global Petrochemicals Market to Witness CAGR of 6.8% by 2020 Owing to Increasing Application Base**

Source: <https://www.transparencymarketresearch.com/pressrelease/petrochemicals.htm>

متوسط قیمت فروش هر تن محصولات پتروشیمی - ۲۰۱۷



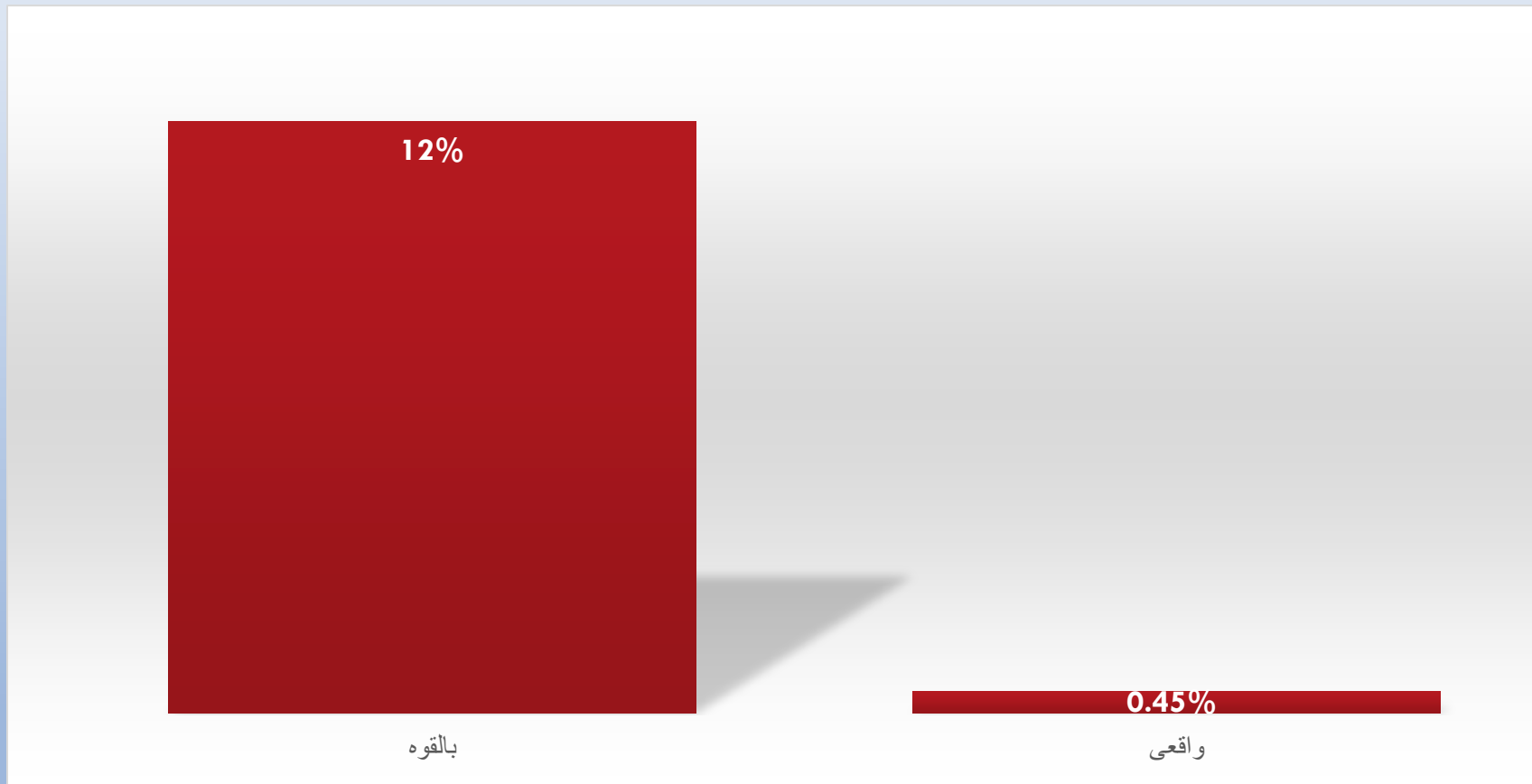
Source:

[Eurostat](#)

[Cefic](#)

[isna](#)

درآمدزایی ایران از زنجیره کامل فرآورده های شیمی و پتروشیمی



Source: 1- www.petrochemistry.eu

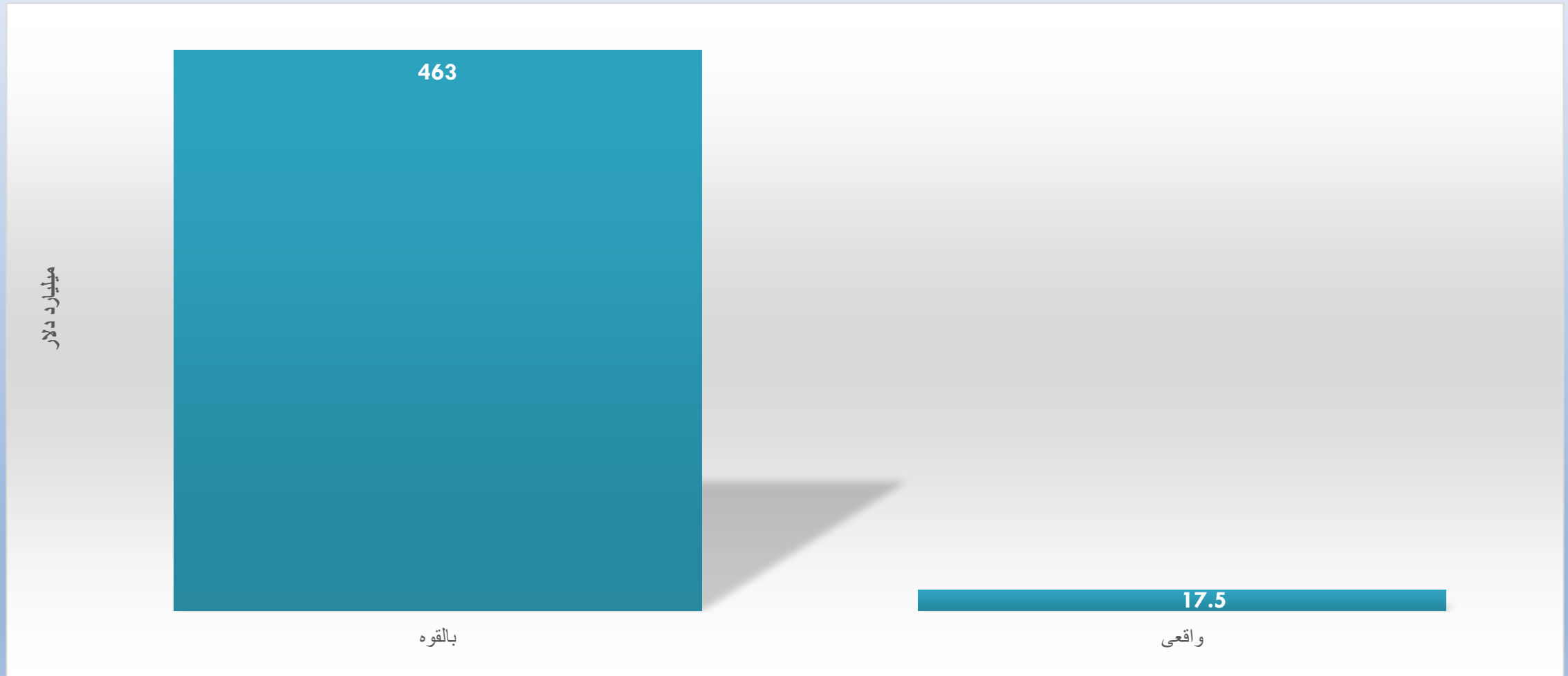
2- گزارش عملکرد صنعت پتروشیمی

صادرات و فروش داخلی ایران: ۱۷.۵ میلیارد دلار

بازار جهانی شیمی و پتروشیمی: ۳۸۵۷ میلیارد دلار



حداقل پتانسیل درآمدزایی ایران از محل زنجیره کامل فرآورده های شیمی پتروشیمی



Source: 1- www.petrochemistry.eu

2- گزارش عملکرد سال ۱۳۹۵ صنعت پتروشیمی

It is crucial to fully leverage new technologies and techniques to upgrade our economy.

"There are hundreds of technologies out there that could impact BP, either positively or negatively, and we're constantly scanning to identify and track these"

- *Technology moves so rapidly that new approaches or ideas can emerge – and fade – within short timescales. This is especially evident in the energy world where the evolution of established technologies, coupled with the increasing influence of digital innovation, together with customer demand and government policies, are changing the way companies operate.*

MAJOR POLYMERS:

THERMOPLASTICS

THERMOSETS

ELASTOMERS

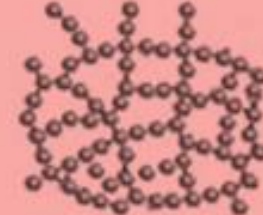
STRUCTURES:



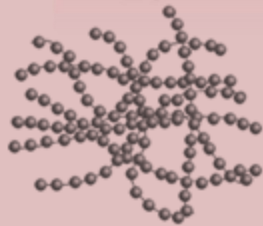
Thermoplastic



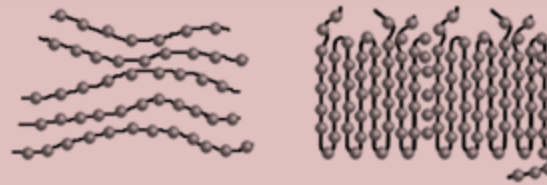
Elastomer



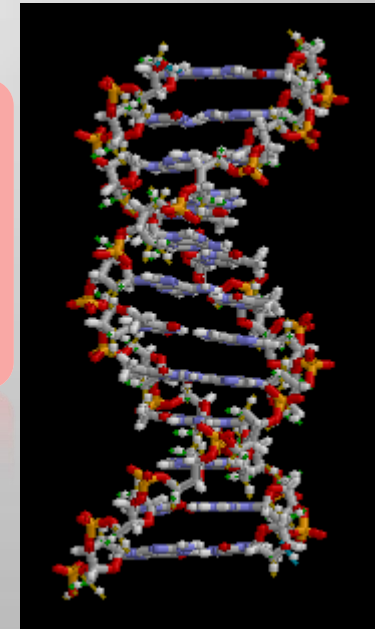
Thermoset

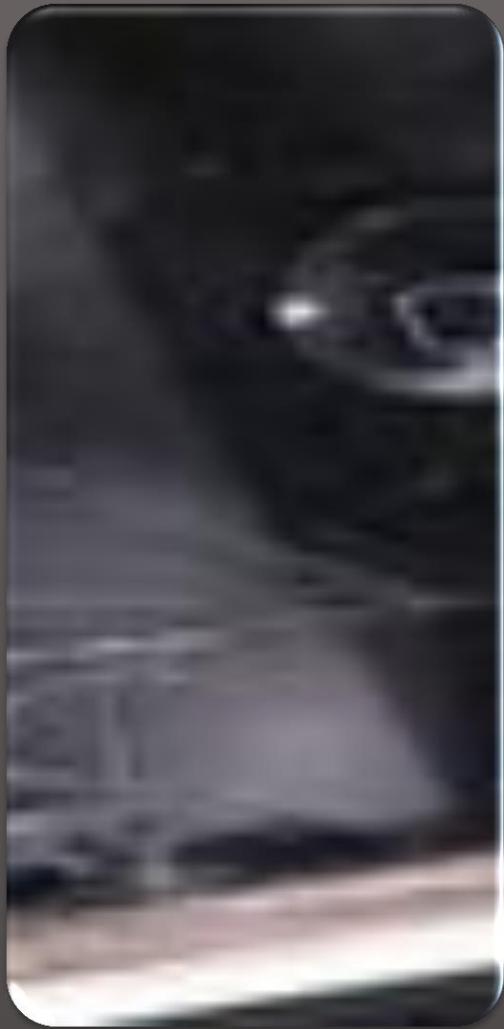


Amorphous structure



Crystal structure (Micellar & Lamellar)





A new polymer can heal itself when damaged similar to the human skin.

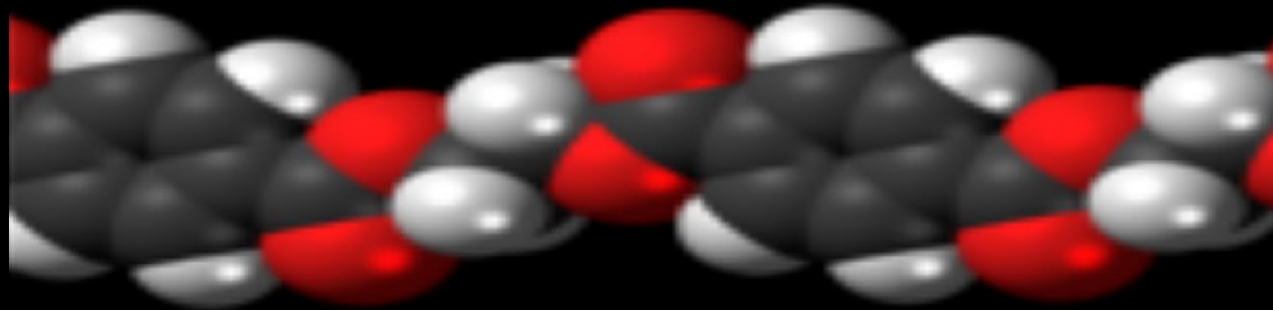


POLYIMIDE, PI:



Polyimides have been in mass production since 1955. With their high heat-resistance, polyimides enjoy diverse applications in applications demanding rugged organic materials, e.g. high temperature fuel cells, displays, and various military roles. A classic polyimide is Kapton, which is produced by condensation of pyromellitic dianhydride and 4,4'-oxydianiline.

POLYETHYLENE TEREPHTHALATE



Chemical formula:



POLYOXYMETHYLENE, POM – PRODUCTS EXAMPLES:



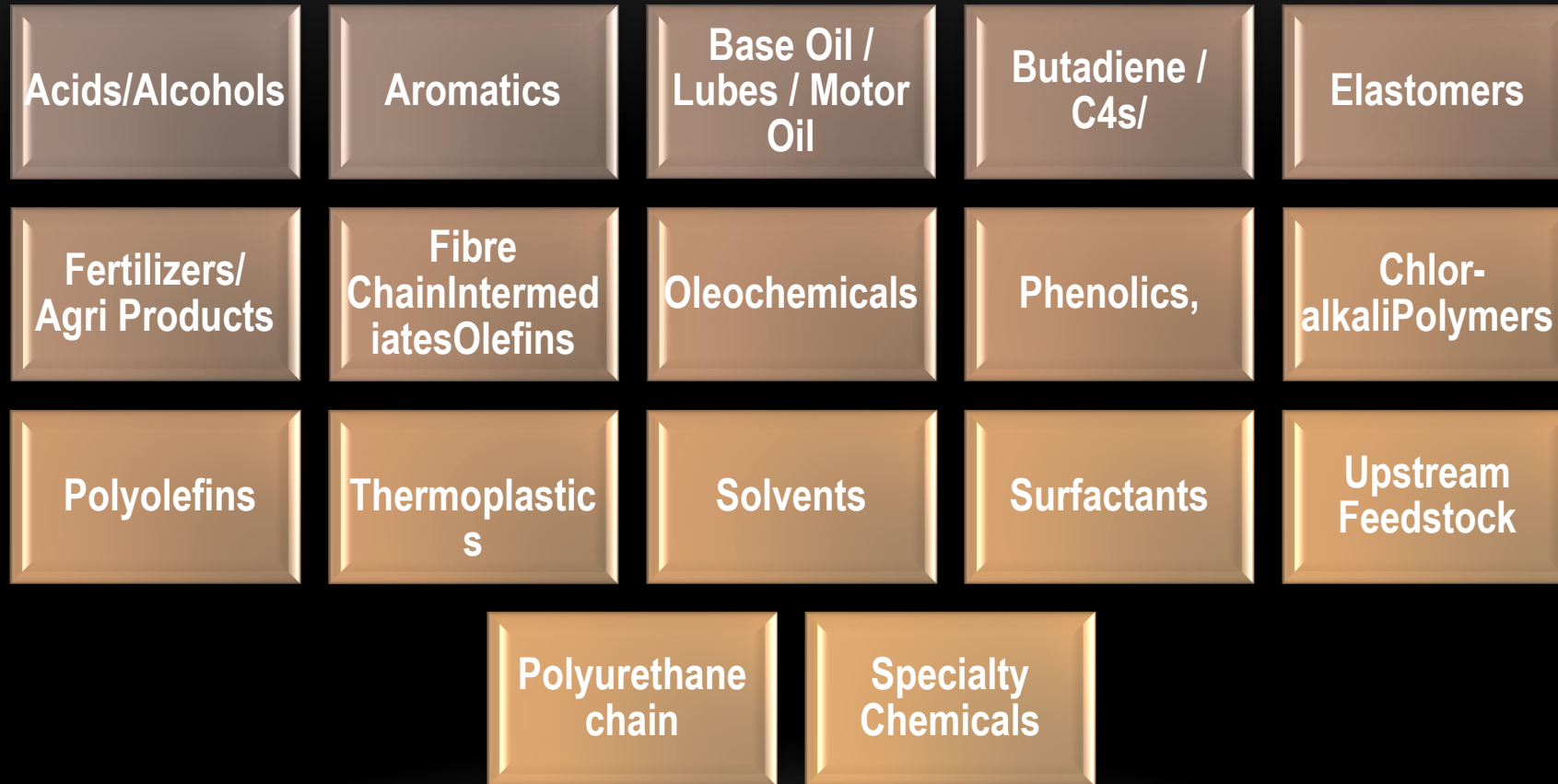


POLYAMIDE, PA, PRODUCTS – EXAMPLES:





New plastic sheets laminated with solar cells protect water and generate energy at the same time.



ENGINEERING PLASTICS:

- Acrylonitrile butadiene styrene (ABS)
- Nylon 6
- Nylon 6-6
- Polyamides (PA)
- Polybutylene terephthalate (PBT)
- Polycarbonates (PC)
- Polyetheretherketone (PEEK)
- Polyetherketone (PEK)
- Polyethylene terephthalate (PET)
- Polyimides
- Polyoxymethylene plastic (POM / Acetal)
- Polyphenylene sulfide (PPS)
- Polyphenylene oxide (PPO)
- Polysulphone (PSU)
- Polytetrafluoroethylene (PTFE / Teflon)
- Ultra-high-molecular-weight polyethylene (UHMWPE / UHMW)

Engineering Thermoplastics are so named as they have properties in one or more areas that exhibit higher performance than commodity materials and are suitable for applications that require engineering to design parts that perform in their intended use.

ENGINEERING PLASTICS



In recent years, the trend of engineering plastics instead of metal materials is significant.

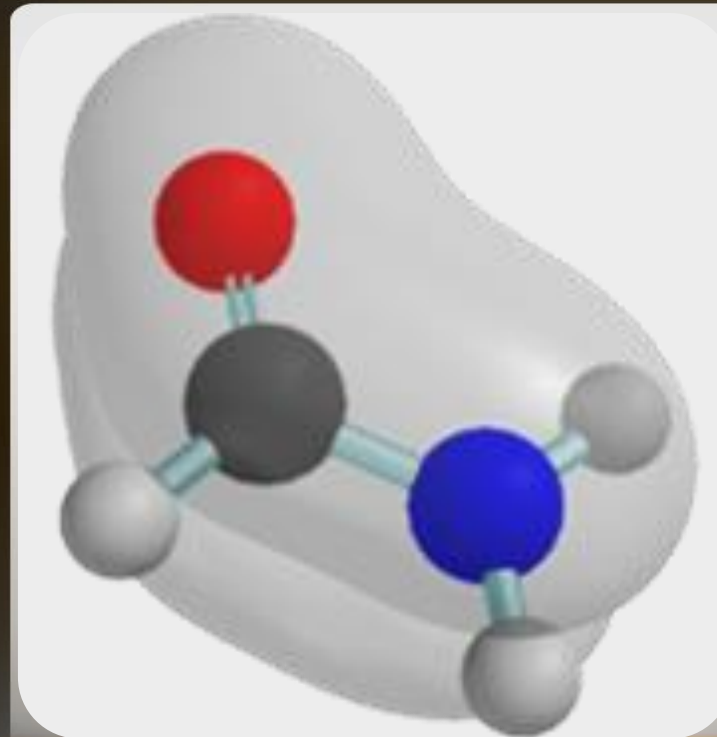
<http://www.reuters.com/article/research-and-markets-idUSnBw155859a+100+BSW20150915>

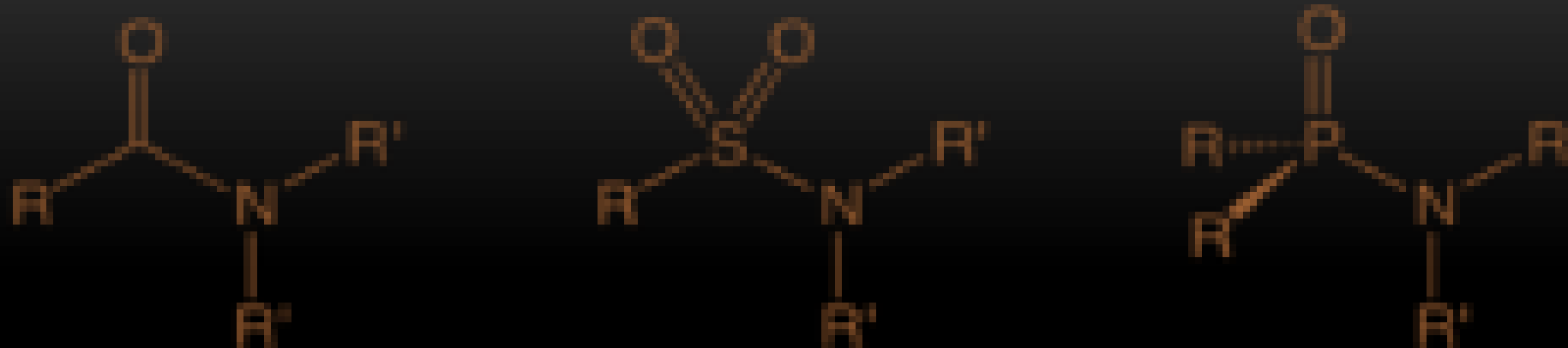


Polyamides (PA)

AMIDES:

An amide (/ˈæmaɪd/ or /ˈæmɪd/ or /ˈeɪmaɪd/),^[4] also known as an acid amide, is a compound with the functional group $R_nE(O)_xNR'_2$ (R and R' refer to H or organic groups). Most common are carboxamides (organic amides) ($n = 1$, $E = C$, $x = 1$), but many other important types of amides are known including phosphoramides ($n = 2$, $E = P$, $x = 1$ and many related formulas) and sulfonamides ($E = S$, $x = 2$).^[4] The term amide refers both to classes of compounds and to the functional group ($R_nE(O)_xNR'_2$) within those compounds.





Structures of three kinds of amides: an organic amide, a sulfonamide, and a phosphoramidate.

AMIDES

POLYAMIDE, PA

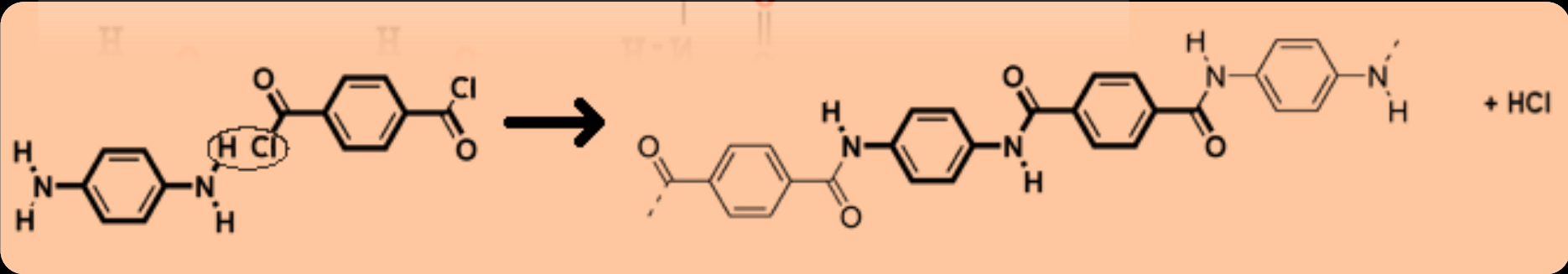
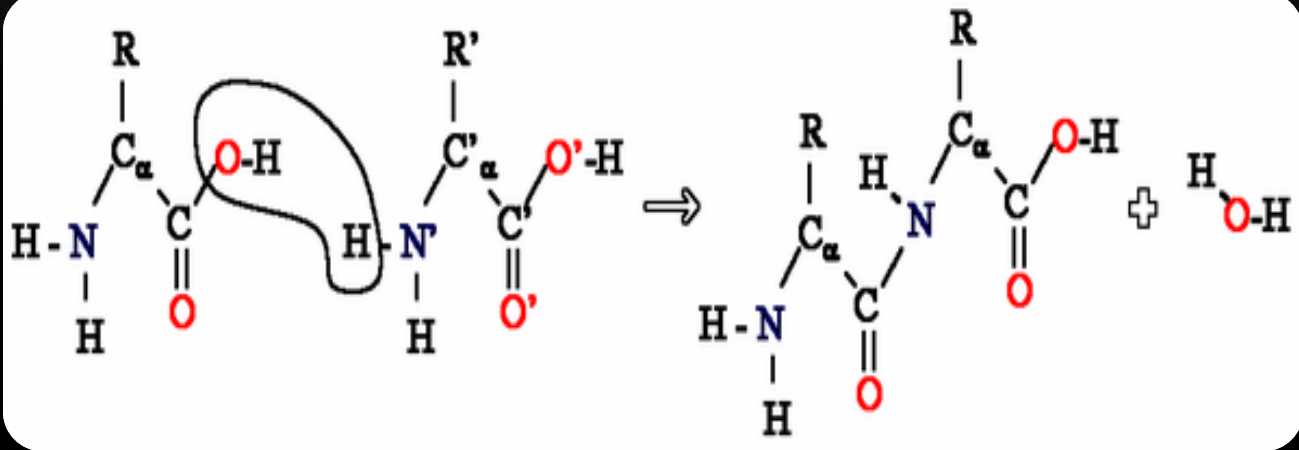
A polyamide is a macromolecule with repeating units linked by amide bonds. Polyamides occur both naturally and artificially. Examples of naturally occurring polyamides are proteins, such as wool and silk. Artificially made polyamides can be made through step-growth polymerization or solid-phase synthesis yielding materials such as nylons, aramids, and sodium poly(aspartate). Synthetic polyamides are commonly used in textiles, automotive applications, carpets and sportswear due to their high durability and strength. **The transportation industry is the major consumer, accounting for 35% of polyamide (PA) consumption.**



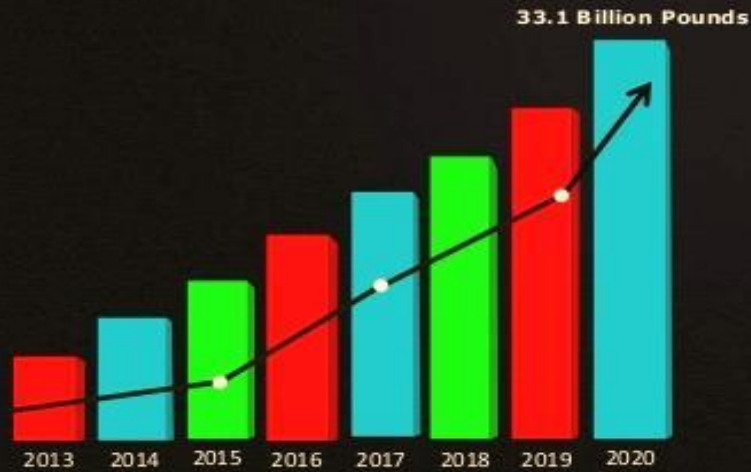
***Polyamide Market
worth 43.77 Billion
USD by 2020.***

www.marketsandmarkets.com/PressReleases/global-nylon.asp

POLYAMIDE, PA



Global market for Polymeric Polyols is forecast to reach 33.1 billion pounds by 2020, driven by growing demand for polyurethane in the automobile, construction, and furniture industries. Strong emphasis on sustainability and the ensuing focus on the development of green technologies for Polyol production is a key trend driving growth in the market. Growth in Asia-Pacific, the fastest growing market, is led by growing population, rapid industrialization and the ensuing high concentration of construction, automotive, and other industries. Eastern Europe and Latin America are also poised to witness rapid growth in the coming years.



Major Players...

- BASF Group
- Bayer AG
- Chemtura Corp.
- Daicel Corporation
- The Dow Chemical Company
- Huntsman International LLC
- Perstorp Holding AB
- Shell Chemicals Ltd.
- SINOPEC Shanghai Gaoqiao Company

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THERMOSET:

Thermoset, or thermosetting, plastics are synthetic materials that strengthen during being heated, but cannot be successfully remolded or reheated after their initial heat-forming. This is in contrast to thermoplastics, which soften when heated and harden and strengthen after cooling.

THERMOSET:

Thermoset materials are generally stronger than thermoplastic materials due to this three-dimensional network of bonds (cross-linking), and are also better suited to high-temperature applications up to the decomposition temperature. However, they are more brittle. Since their shape is permanent, they tend not to be recyclable as a source for newly made plastic.

THERMOSET - EXAMPLS

Polyester fibreglass systems: sheet molding compounds and bulk molding compounds

Polyurethanes: insulating foams, mattresses, coatings, adhesives, car parts, print rollers, shoe soles, flooring, synthetic fibers, etc. Polyurethane polymers are formed by combining two bi- or higher functional monomers/oligomers. This common type of thermoset material has also recently shown to have transient properties and can thus be reprocessed or recycled.^[3]

Vulcanized rubber

Bakelite, a phenol-formaldehyde resin used in electrical insulators and plasticware

Duroplast, light but strong material, similar to bakelite used for making car parts

Urea-formaldehyde foam used in plywood, particleboard and medium-density fiberboard

Melamine resin used on worktop surfaces^[4]

Diallyl-phthalate (DAP) used in high temperature and mil-spec electrical connectors and other components. Usually glass filled.

Epoxy resin used as the matrix component in many fiber reinforced plastics such as glass-reinforced plastic and graphite-reinforced plastic

Polyimides used in printed circuit boards and in body parts of modern aircraft

Cyanate esters or polycyanurates for electronics applications with need for dielectric properties and high glass temperature requirements in composites

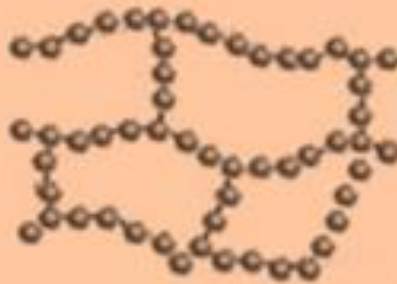
Mold or mold runners (the black plastic part in integrated circuits or semiconductors)

Polyester resins

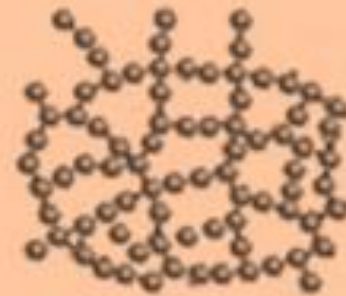
Thermoset materials are those materials that are made by polymers joined together by chemical bonds, acquiring a highly crosslinked polymer structure. The highly crosslinked structure produced by chemical bonds in thermoset materials, is directly responsible for the high mechanical and physical strength (high strength to support high stress or load, temperature ...) compared with thermoplastics or elastomers materials. On the other hand is this highly crosslinked structure which provides a poor elasticity or elongation of this materials.



Thermoplastic

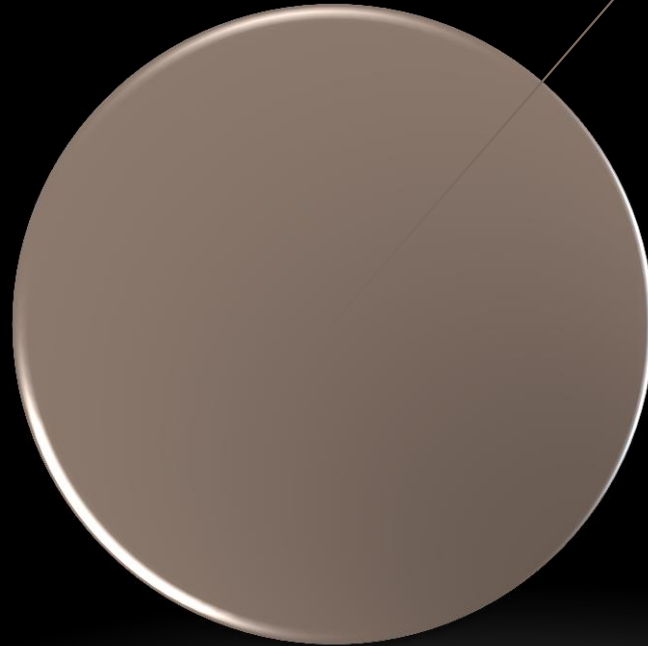


Elastomer



Thermoset

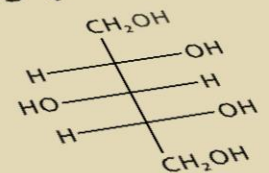
POLYOLS



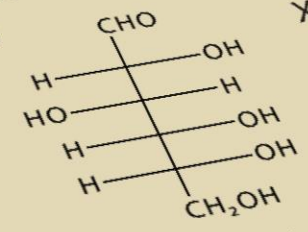
Sugar Alcohols (Polyols)



Sorbitol

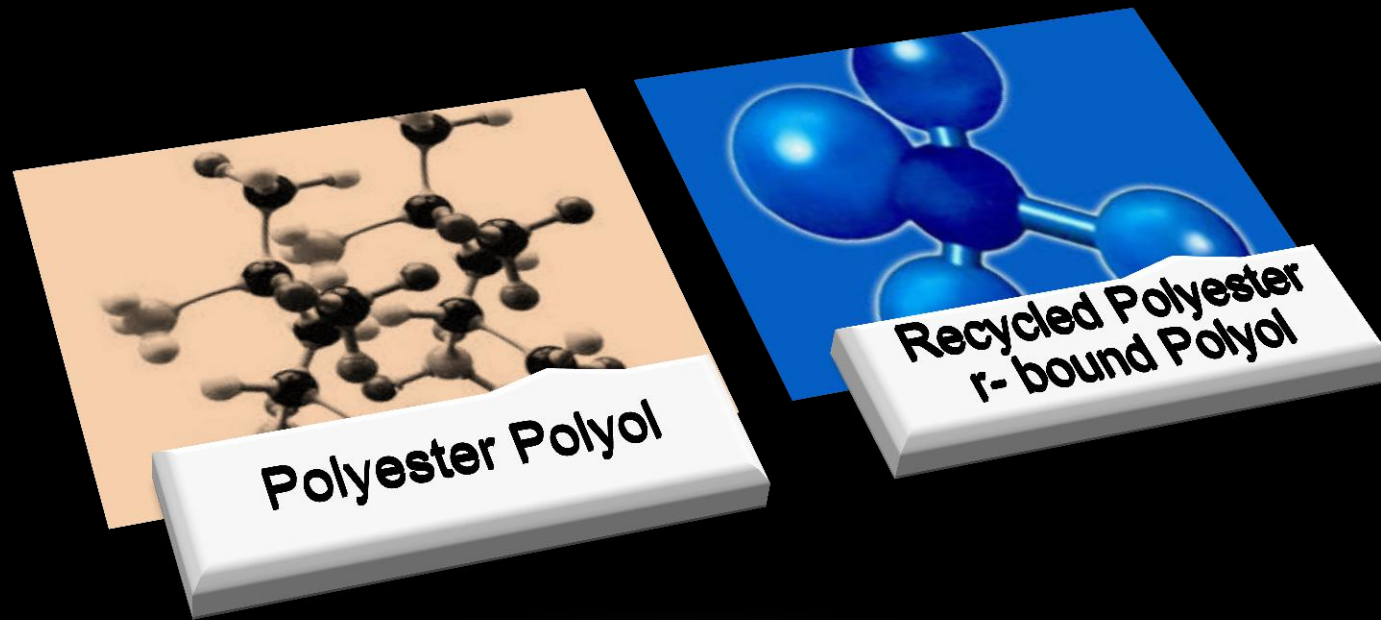


Xylitol



Glucose

Sugar Alcohols (Polyols)

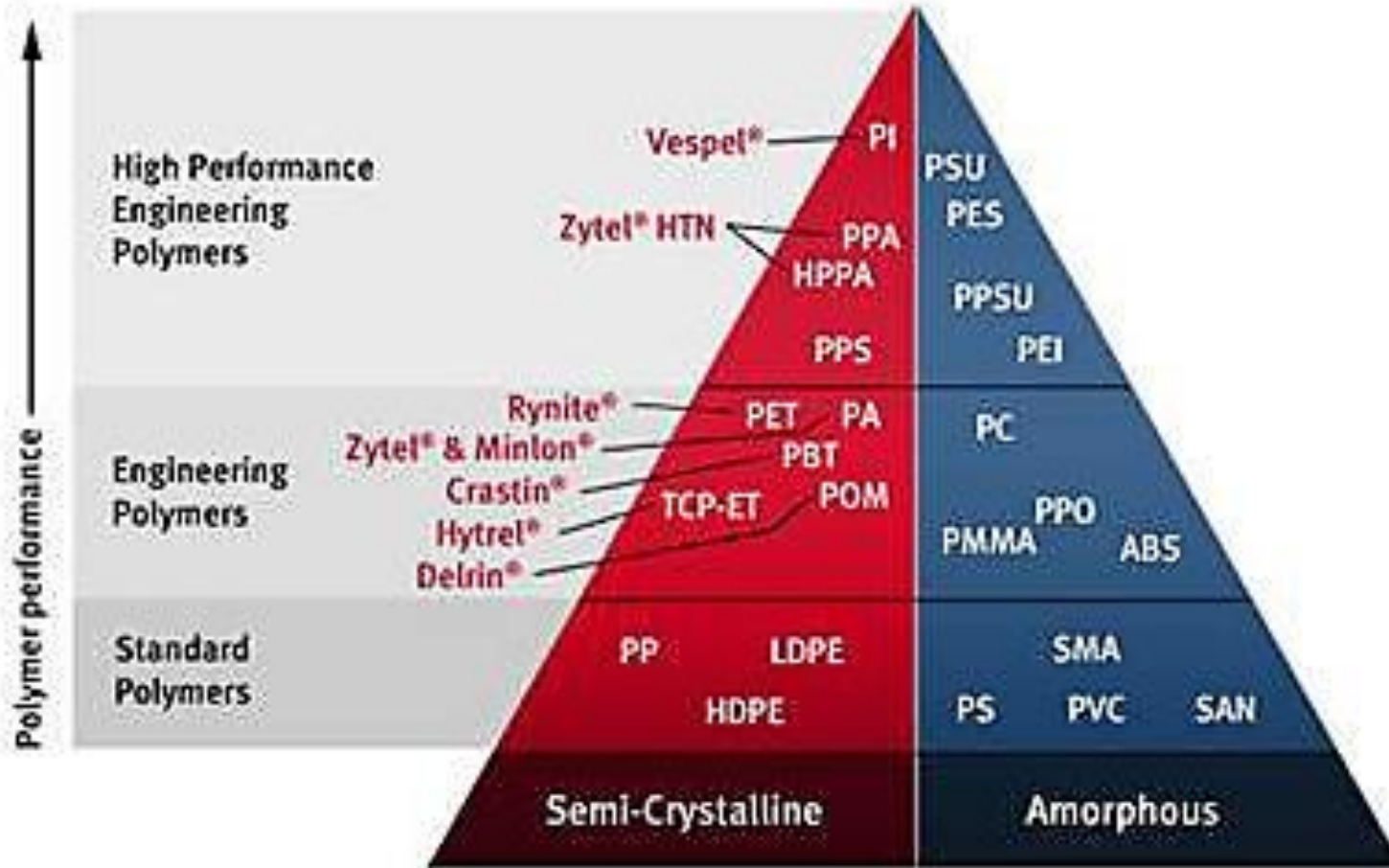


Low Viscosity Epoxy With Exceptional Chemical Resistance



Master Bond EP62-1BF is a two part epoxy featuring the ability to withstand exposure to aggressive chemicals including acids, bases and solvents, even at high temperatures. This low exotherm system has a mixed viscosity of 2,000-5,000 cps, enabling it to be used for potting small components. EP62-1BF is thermally stable and has a glass transition temperature (Tg) of 125-135°C. It is serviceable from -60°F to +400°F

HIGH PERFORMANCE POLYAMIDE PYRAMID



The Ultimate in High-Performance Plastics:

*Not many polymers can withstand
the extreme environments found in a
wide variety of industrial
applications, from aerospace and
automotive to deep sea oil drilling
and almost everything in between.*



US\$ 300 BILLION POLYMER INDUSTRY

AEM participates in the highest value applications of the \$300+ billion polymers industry

Transformation
Through
Technology

Specialty
Engineering
Polymers

Standard
Polymers

~10% of polymer
industry volume

~90% of
industry
volume is
standard

Service temperature

AEM Polymers

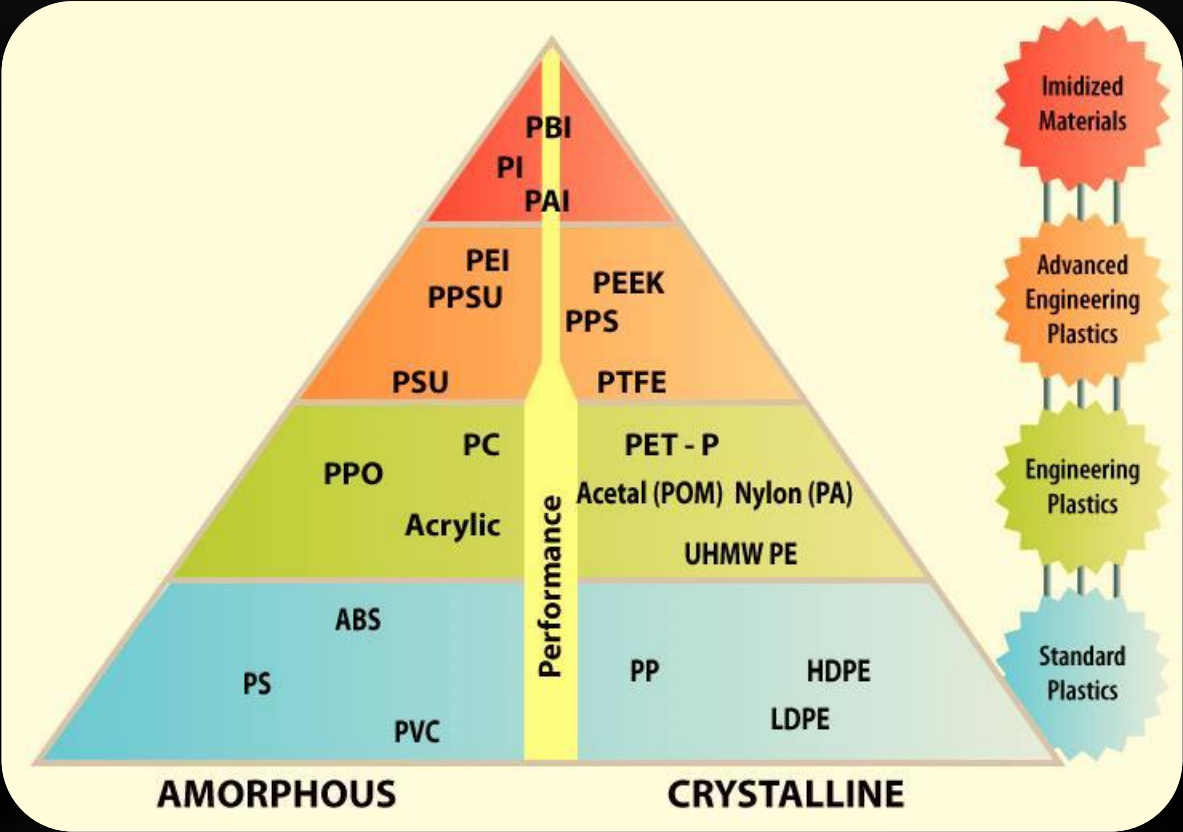
Celanex® PBT
Celcon® POM
Celstran® LFRT
Compel® LFRT
Fortron® PPS
GUR® UHMW-PE
Hostaform® POM
Impet® PET
Riteflex® TPC-ET
Thermx® PCT
Vandar® PBT
Vectra® LCP
Zenite® LCP

Broadest polymer offerings in highest performance applications

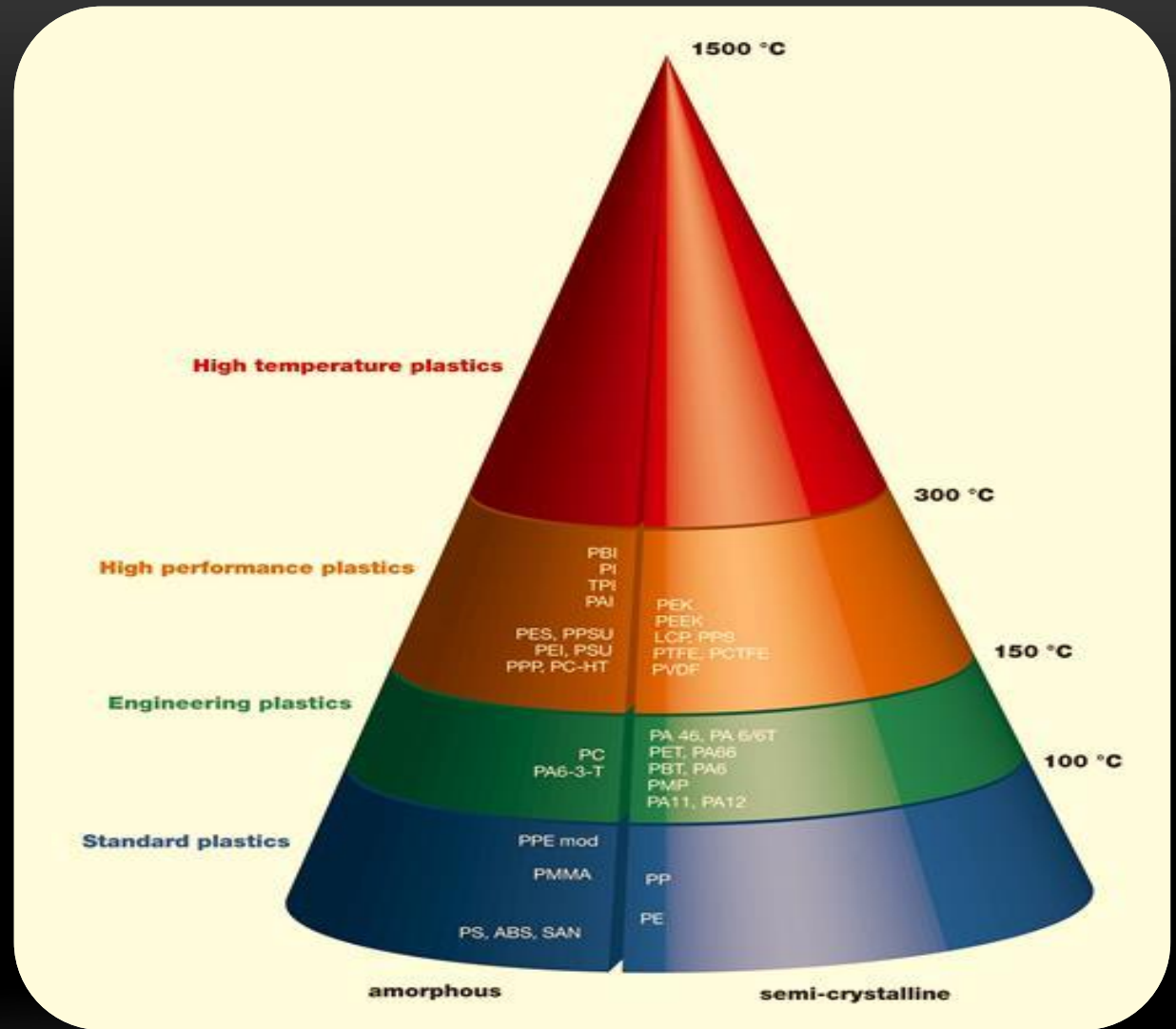
Source: SFI Consulting

 **Celanese**

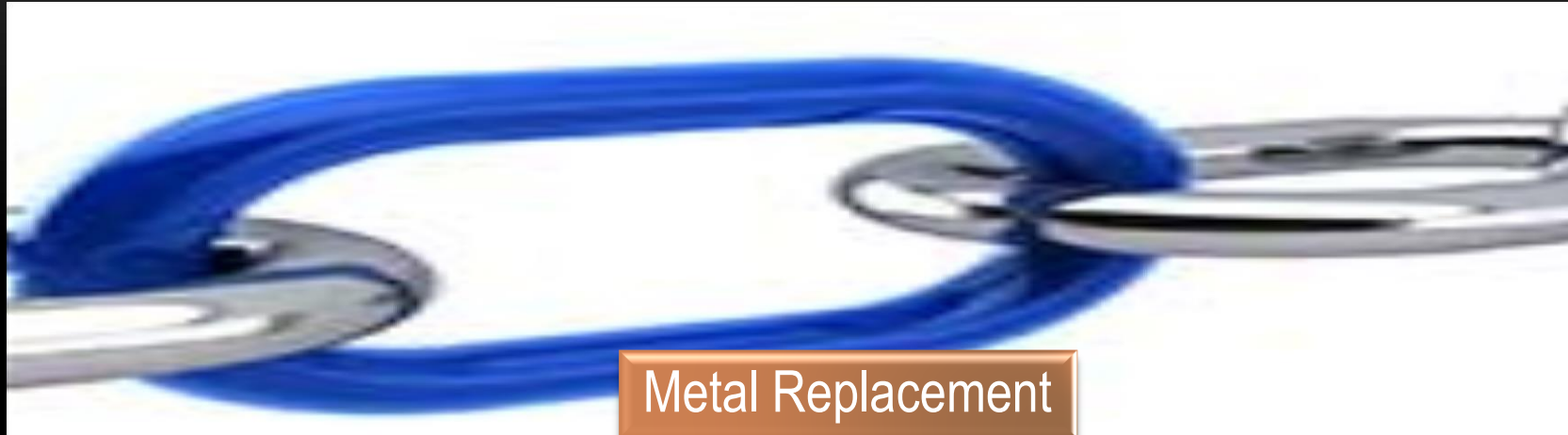
PLASTIC TRIANGLE



TEMPERATURE PYRAMID



HIGH PERFORMANCE ENGINEERING THERMOPLASTIC COMPOUNDS



Metal Replacement



Tribology

ENGINEERED THERMOPLASTIC SOLUTIONS

Instrument Panels

- > Retainers
- > Center Stacks
- > Back-lit Buttons & Switches

Sunroofs

- > Rails
- > Slides
- > Housings

Seating

- > Arm Rests
- > Seat Pans
- > Slides
- > Handles

Airbag Retainers

- > Housings
- > Brackets

Door Systems

- > Lift Components
- > Module Carriers
- > Latches
- > Handles



Shifter Bases

- > Housings
- > Levers
- > Frames

Fuel Systems

- > Gas Caps
- > Clips
- > Connectors
- > Filler Tubes

Engineered Thermoplastic Solutions

Drivetrain

- > Seal Rings
- > Thrust Washers
- > Bushings

Pedal Boxes

- > Housings
- > Brackets
- > Wear Components

Sensor Housings

- > Drivetrain
- > Emission
- > Safety & Security

Front End Modules

- > Carriers
- > GOR's
- > Cooling Modules

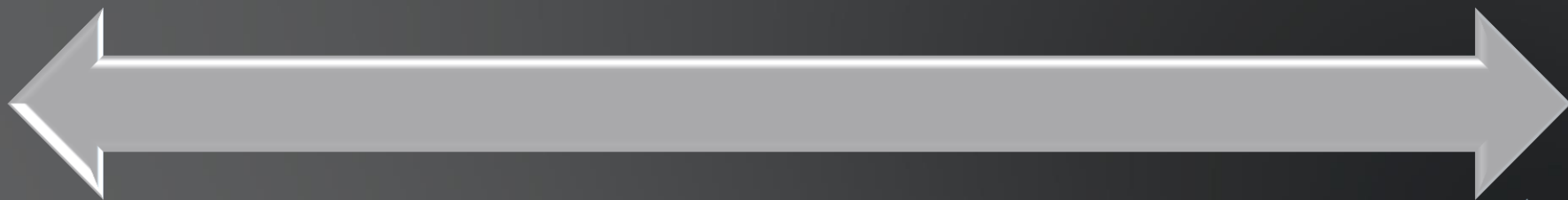


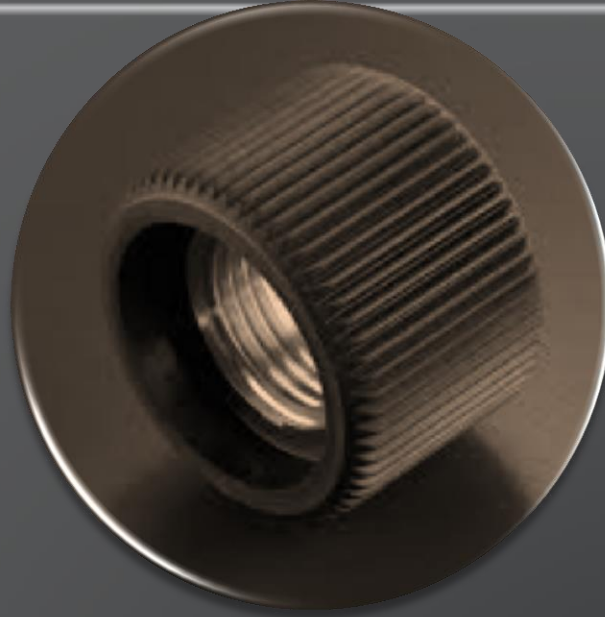


Engineering Plastics

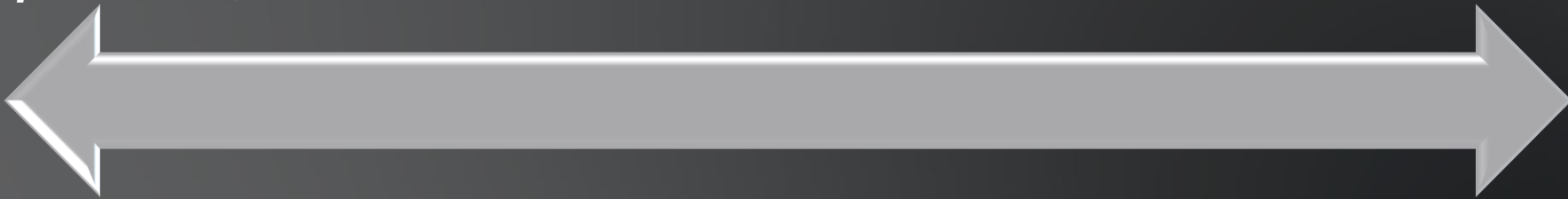


Thermosetting plastics retain their strength and shape even when heated. This makes thermosetting plastics well-suited to the production of permanent components and large, solid shapes. Additionally, these components have excellent strength attributes and will not become weaker when the temperature increases.





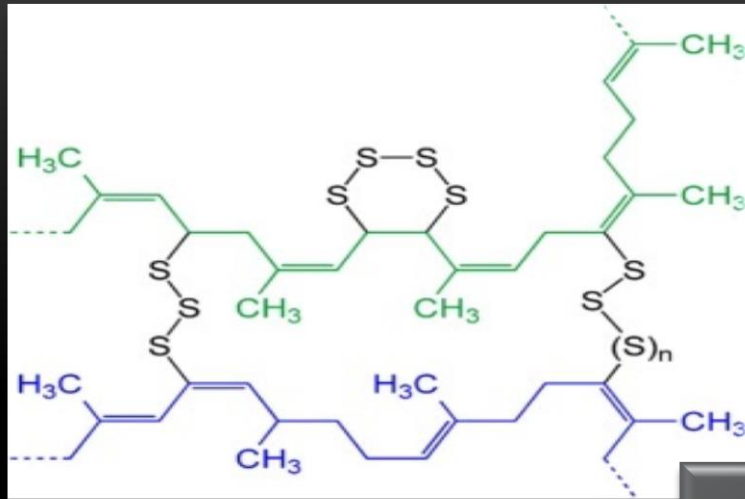
Each type of thermosetting plastic has a unique set of properties. Epoxies, for example, exhibit elasticity and exceptional chemical resistance, and are relatively easy to cure. Phenolics, while fairly simple to mold, are brittle, strong and hard. Because of their wide range of characteristics, thermosetting plastics find use in an extensive variety of applications, from electrical insulators to car bodies.





Researchers at Texas A&M University have developed a spongy plastic that could help regenerate broken bones.





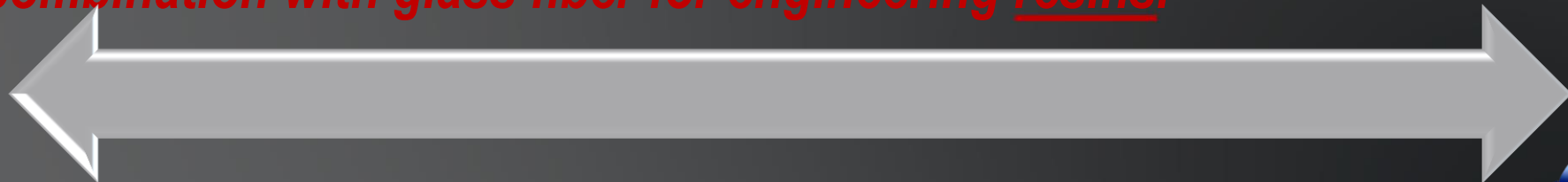
***Schematic presentation
of two strands (blue and
green) of natural rubber
after vulcanization with
elemental sulfur.***



POLYETHYLENE TEREPHTHALATE, PET



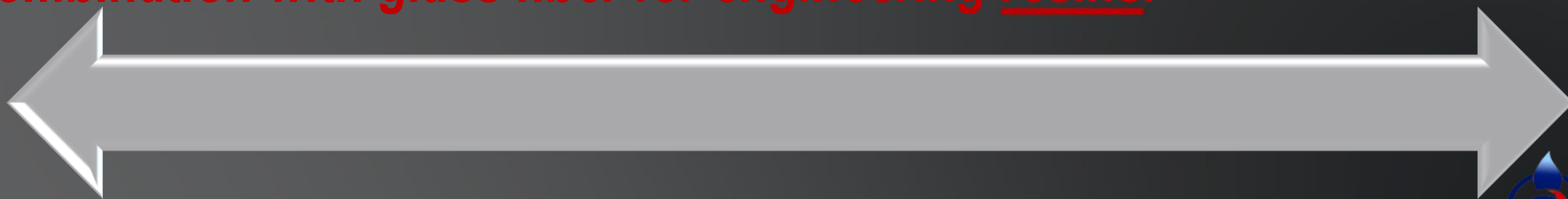
Polyethylene terephthalate (sometimes written poly(ethylene terephthalate)), commonly abbreviated PET, PETE, or the obsolete PETP or PET-P, is the most common thermoplastic polymer resin of the polyester family and is used in fibers for clothing, containers for liquids and foods, thermoforming for manufacturing, and in combination with glass fiber for engineering resins.



POLYETHYLENE TEREPHTHALATE, PET:



Polyethylene terephthalate (sometimes written poly(ethylene terephthalate)), commonly abbreviated PET, PETE, or the obsolete PETP or PET-P, is the most common thermoplastic polymer resin of the polyester family and is used in fibers for clothing, containers for liquids and foods, thermoforming for manufacturing, and in combination with glass fiber for engineering resins.

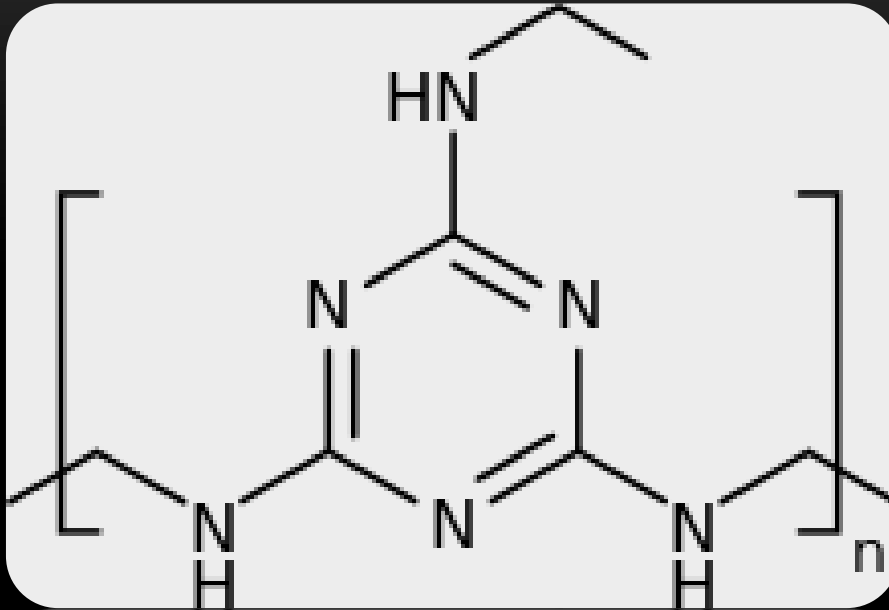


POLYIMIDE FILM - A BROAD RANGE AND EMERGING MARKETS:



Polyimide film is consumed in a broad range of markets due to its unique physical properties and ability to satisfy the demanding needs in each market.

MELAMINE FORMALDEHYDE:



Melamine resin or melamine formaldehyde (also shortened to melamine) is a hard, thermosetting plastic material made from melamine and formaldehyde by polymerization. In its butylated form, it is dissolved in n-butanol and xylene. The principal use of melamine resin is the main constituent of high-pressure laminates, such as Formica and Arborite, and of laminated flooring. Melamine-resin tile wall panels can also be used as whiteboards.^[2] Melamine formaldehyde is used in plastic laminate and overlay materials. Formaldehyde is more tightly bound in MF than it is in urea-formaldehyde, reducing emissions.





Automotive Products

Chassis System

Engine system

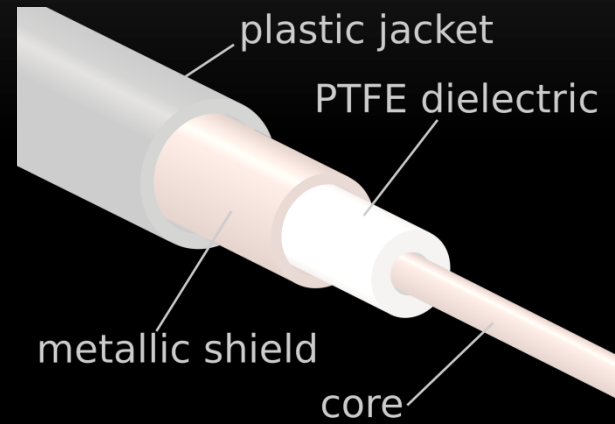
Body system

Electrical system

Others



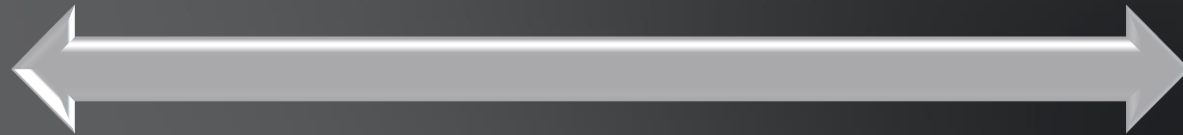
FLUOROPOLYMERS, PTFE:



FLUOROPOLYMERS – APPLICATIONS:



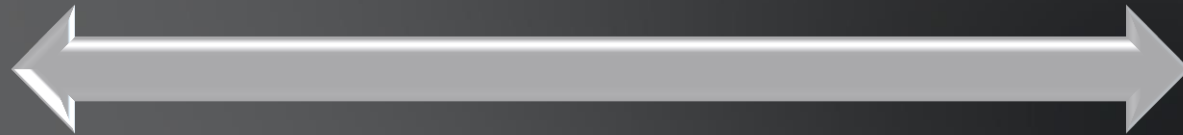
- 1. High-performance automotive and aircraft bearings and seals, to improve the performance and safety of aircraft and automobiles .***
- 2. Flame retardants, to reduce fire risk in high-rise buildings and reduce industrial and automotive pollution.***





3. Coatings on many kitchen products, such as pots, pans, knives, spatulas etc. thanks to their high thermal stability and non-stick properties .

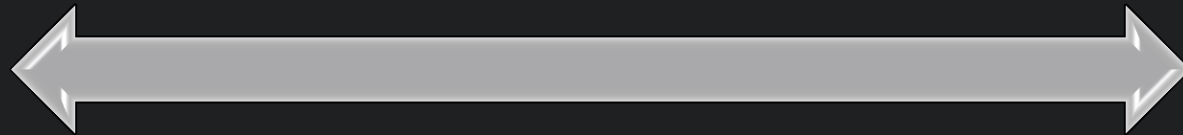
4. The linings of piping and chemical tanks, and in packing for lithium-ion batteries, thanks to their ability to handle harsh environments .





5. Cable coating in the telecommunications and computer industries, because of their high electrical resistance and good dielectric properties.

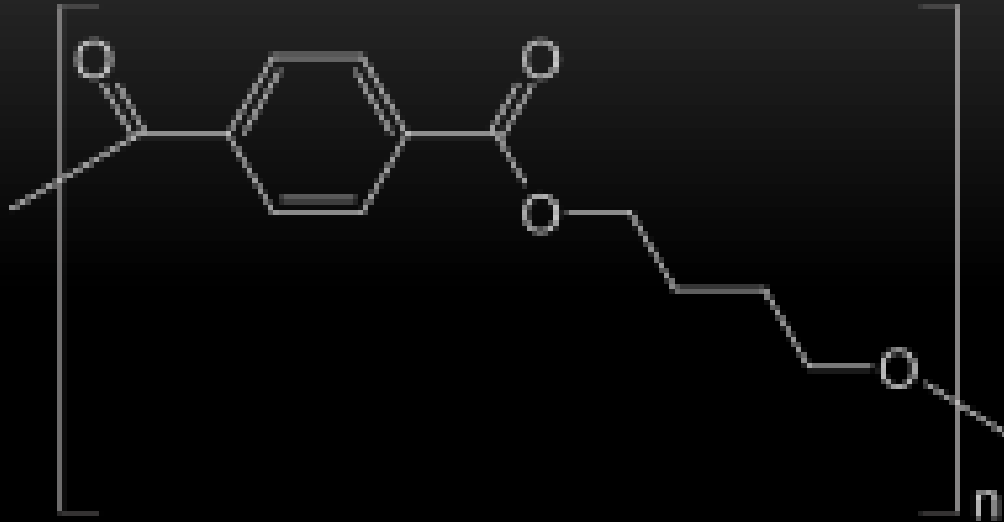
6. Implantable parts and catheters for bio-medical applications, because of their resistance to chemicals.







POLYBUTYLENE TEREPHTHALATE, PBT



Polybutylene terephthalate (PBT); (C₁₂H₁₂O₄)_n, is a thermoplastic engineering polymer that is used as an insulator in the electrical and electronics industries. It is a thermoplastic (semi-)crystalline polymer, and a type of polyester. PBT is resistant to solvents, shrinks very little during forming, is mechanically strong, heat-resistant up to 150 °C (or 200 °C with glass-fibre reinforcement) and can be treated with flame retardants to make it noncombustible.



POLYBUTYLENE TEREPHTHALATE, PBT:



PBT is a thermoplastic polyester that is semi-crystalline*. In contrast with PET, which is stronger with higher use temperature and lower cost, PBT is very stable, has high lubricity and surface gloss. PBT also has good chemical resistance, electrical properties and low moisture absorption. PBT will crystallize rapidly. Mold cycles are short and molding temperatures can be lower than for many engineering plastics. PBT is available with reinforcement, both GF and MF.



POLYBUTYLENE TEREPHTHALATE, PBT – MARKET SIZE:



The market size of global PBT market reached USD 33.7 billion in 2014, and it is estimated this market will still grow with a CAGR of nearly 7.3% from 2014 to 2019.

POLYARYLETHETHERKETONE, PEEK:



In 1983 – ICI
and Bayer
launch PEEK.

POLYARYLETHETHERKETONE, PEEK:



Polyaryletheretherketone (PAEK) materials are semi-crystalline, high purity polymers comprising of repeating monomers of two ether groups and a ketone group," according to the very helpful British Plastics Federation (link is external) website.

- See more at:

<http://road.cc/content/news/54222-carbon-bolts-ultimate-weight-weenie-component#sthash.e0md9Dli.dpuf>



POLYARYETHERETHERKETONE, PEEK:



They're currently available in a limited range of sizes in M5 and M6 threads, and they weigh between 0.7 and 1.3g each. Prices are £36 for a pack of four M5 bolts and £44 for four M6-threaded bolts.

- See more at:

<http://road.cc/content/news/54222-carbon-bolts-ultimate-weight-weenie-component#sthash.e0md9Dli.dpuf>

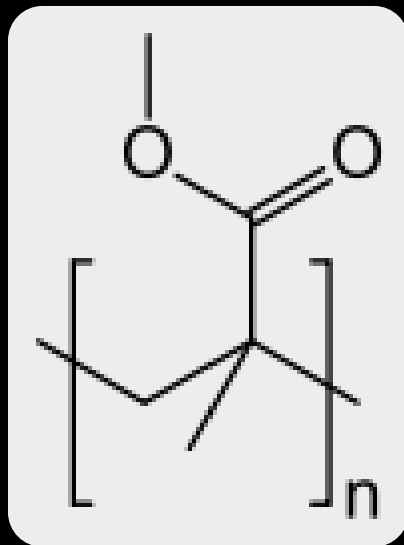


POLY ARYL ETHER ETHER KETONE, PEEK – MARKET SIZE:

The global Polyether Ether Ketone (PEEK) Market is estimated to be worth US\$831 mm by 2018, as per Research and Markets. The market volume is expected to grow at a CAGR of 8.2% from 2013 to 2018. The high demand of industrial, electronics & electrical, automotive from across the globe will boost the demand of PEEK.



POLY METHYL METHACRYLATE, **PMMA**:



10 meter deep Monterey Bay Aquarium tank has acrylic windows up to 33 cm thick to withstand the water pressure.

POLYMETHYL METHACRYLATE, PMMA:



Poly(methyl methacrylate) (PMMA), also known as acrylic or acrylic glass as well as by the trade names Plexiglas, Acrylite, Lucite, and Perspex among several others (see below), is a **transparent thermoplastic** often used in sheet form as a **lightweight or shatter-resistant alternative to glass**. The same material can be utilised as a casting resin, in inks and coatings, and has many other uses.



PMMA is a strong and lightweight material. It has a **density** of $1.17\text{--}1.20\text{ g/cm}^3$ which is less than half that of glass. It also has good impact strength, higher than both glass and polystyrene; however, PMMA's impact strength is still significantly lower than polycarbonate and some engineered polymers. PMMA ignites at $460\text{ }^\circ\text{C}$ ($860\text{ }^\circ\text{F}$) and **burns**, forming **carbon dioxide**, **water**, **carbon monoxide** and low-molecular-weight compounds, including **formaldehyde**.



POLYOXYMETHYLENE, POM – **MARKET SIZE:**



POM market to reach \$3.3 billion by 2018. *The market for POM in terms of revenue was estimated to be worth \$2.2 billion in 2012 and is expected to reach \$3.3 billion by 2018, expected to grow at a CAGR of 6.2%, in terms of revenue, from 2013 to 2018. APAC region dominated the POM market, accounting for 45.6% of the POM market revenue in 2012.* <http://www.marketsandmarkets.com/PressReleases/polyoxymethylene.asp>

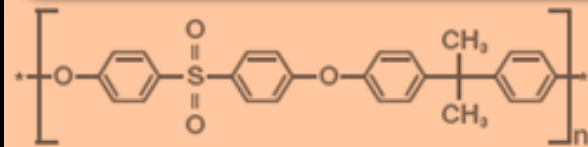
POLYOXYMETHYLENE, POM:

Polyoxymethylene (POM), also known as **acetal**,^[1] **polyacetal** and **polyformaldehyde**, is an engineering **thermoplastic** used in precision parts requiring high stiffness, low friction and excellent dimensional stability. As with many other synthetic **polymers**, it is produced by different chemical firms with slightly different formulas and sold variously by such names as **Delrin**, **Celcon**, **Ramtal**, **Duracon**, **Kepital** and **Hostaform**.

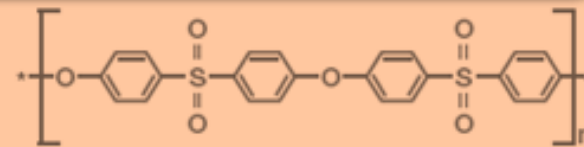
Typical applications for injection-molded POM include high performance engineering components such as small gear wheels, ball bearings, ski bindings, fasteners, knife handles, and lock systems. The material is widely used in the automotive and consumer electronics industry.

POLYARYLSULFONES (PSU, PESU, PPSU):

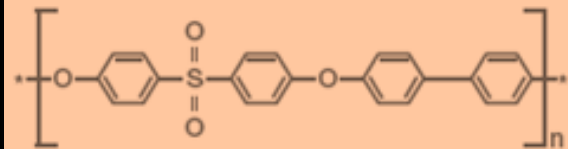
Polyarylsulfones are amorphous, thermoplastic polycondensation products with the following basic structures:



Polysulfone (PSU)

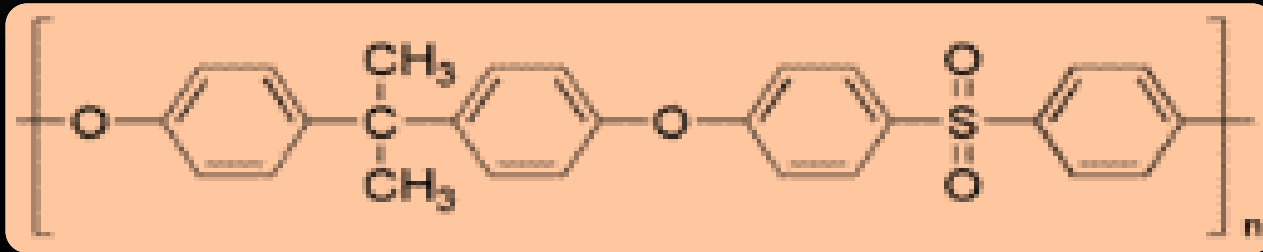


Polyethersulfone (PESU)



Polyphenylenesulfone (PPSU)

POLYARYLSULFONE, PSU/P/PPSU:



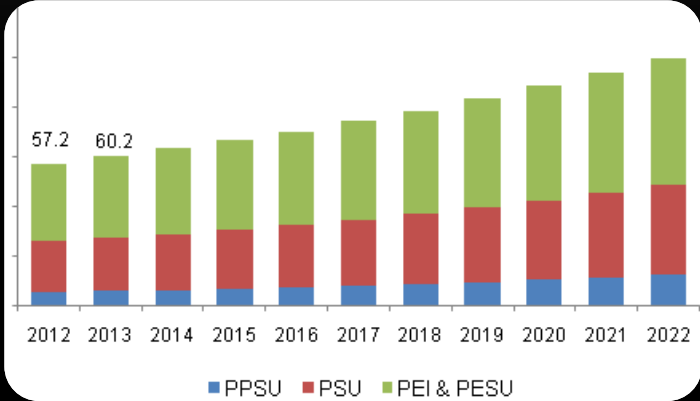
A typical polysulfone is produced by the reaction of a diphenol and bis(4-chlorophenyl)sulfone, forming a polyether by elimination of sodium chloride: $n \text{HOC}_6\text{H}_4\text{OH} + n (\text{ClC}_6\text{H}_4)_2\text{SO}_2 + n \text{Na}_2\text{CO}_3 \rightarrow [\text{OC}_6\text{H}_4\text{OC}_6\text{H}_4\text{SO}_2\text{C}_6\text{H}_4]_n + 2n \text{NaCl} + n \text{H}_2\text{O} + n \text{CO}_2$. The diphenol is typically bisphenol-A or 1,4-dihydroxybenzene. Such step polymerizations require highly pure monomer to ensure high molecular weight products.

POLYARYLSULFONE (PSU/PESU/PPSU) APPLICATIONS:

Polyarylsulfone is used in the automotive industry for headlights and interior reflectors, in the electrical and electronics industry for fuse encapsulation, to make water fittings, pump impellers, baby bottles, microwave dishes and thin hollow fibres for water treatment.



POLYARYLSULFONE (PSU/PESU/PPSU) – MARKET SIZE:



Global polyarylsulfone demand was 63.3 kilo tons in 2014 and is expected to exceed 100 kilo tons by 2022, growing at a CAGR of 6.0% from 2015 to 2022.

POLYPHTHALAMIDE, PPA:

PPA (**Polyphthalamide**) is a high heat resistant semi-aromatic polyamide. As a member of the nylon family it is a semi-crystalline material composed from a diacid and a diamine. PPAs are polyamides containing aromatic rings in the diacid part of their backbones, which gives them high mechanical strength and thermal resistance.

POLYPHTHALAMIDE, PPA:



With outstanding electrical properties, PPA is commonly used in the electrical and automotive industries as:



connectors



switches



and for electrical insulation



Other PPA applications include:



motor insulators



water heater manifolds



valve bodies for showers,



fuel modules



fuel cut-off valves



thermostat housings



air coolers

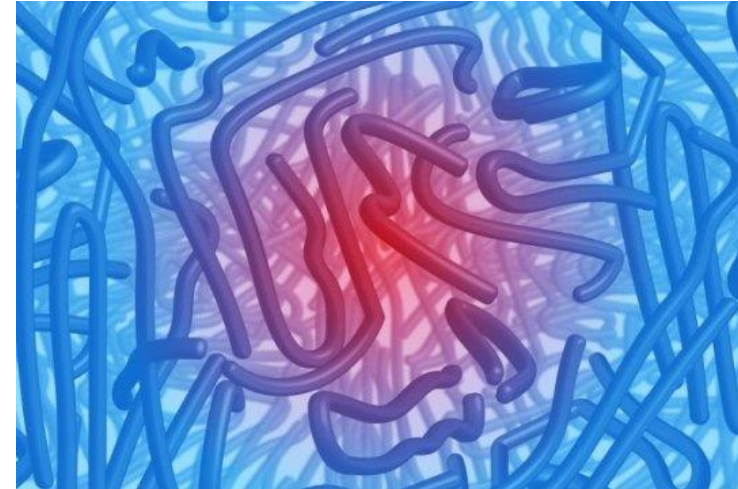
Engineers turn plastic insulator into heat conductor

Technique could prevent overheating of laptops, mobile phones, and other electronics

Date: March 30, 2018

Source: Massachusetts Institute of Technology

Plastics are excellent insulators, meaning they can efficiently trap heat -- a quality that can be an advantage in something like a coffee cup sleeve. But this insulating property is less desirable in products such as plastic casings for laptops and mobile phones, which can overheat, in part because the coverings trap the heat that the devices produce.



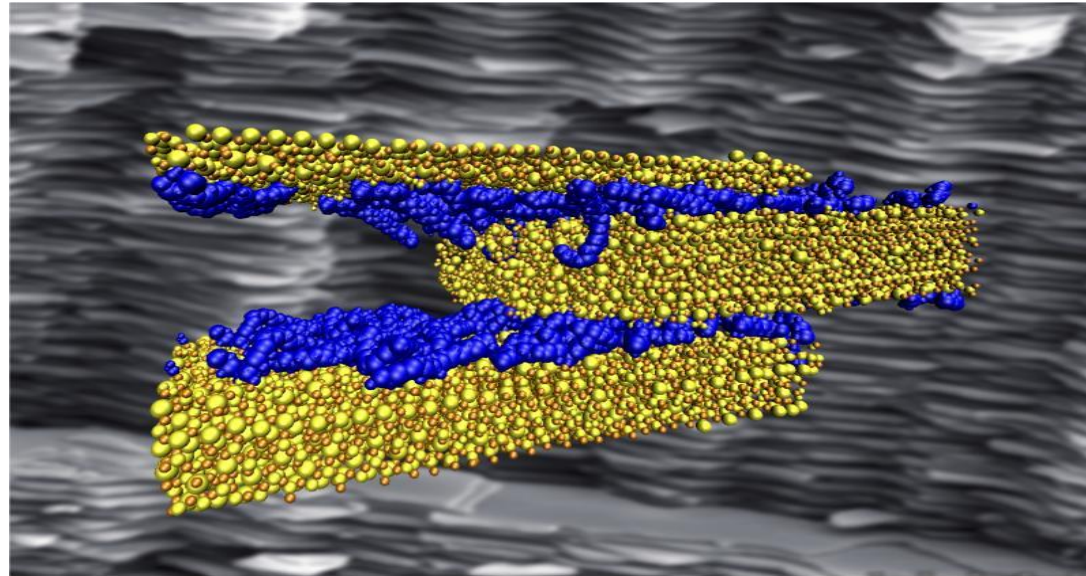
The new technique could prevent overheating of laptops, mobile phones, and other electronics.

Now a team of engineers at MIT has developed a polymer thermal conductor -- a plastic material that, however counterintuitively, works as a heat conductor, dissipating heat rather than insulating it. The new polymers, which are lightweight and flexible, can conduct 10 times as much heat as most commercially used polymers.

Weak Hydrogen Bonds Provide a Strong, Tough Infrastructure

01/30/2018 - [Comments](#) by Mike Williams, Rice University

The right mix of hydrogen bonds in polymer and cement composites is critical to making strong, tough and ductile infrastructure material, according to Rice University scientists who want to mimic the mechanics of mother-of-pearl and similar natural composites with synthetic materials.

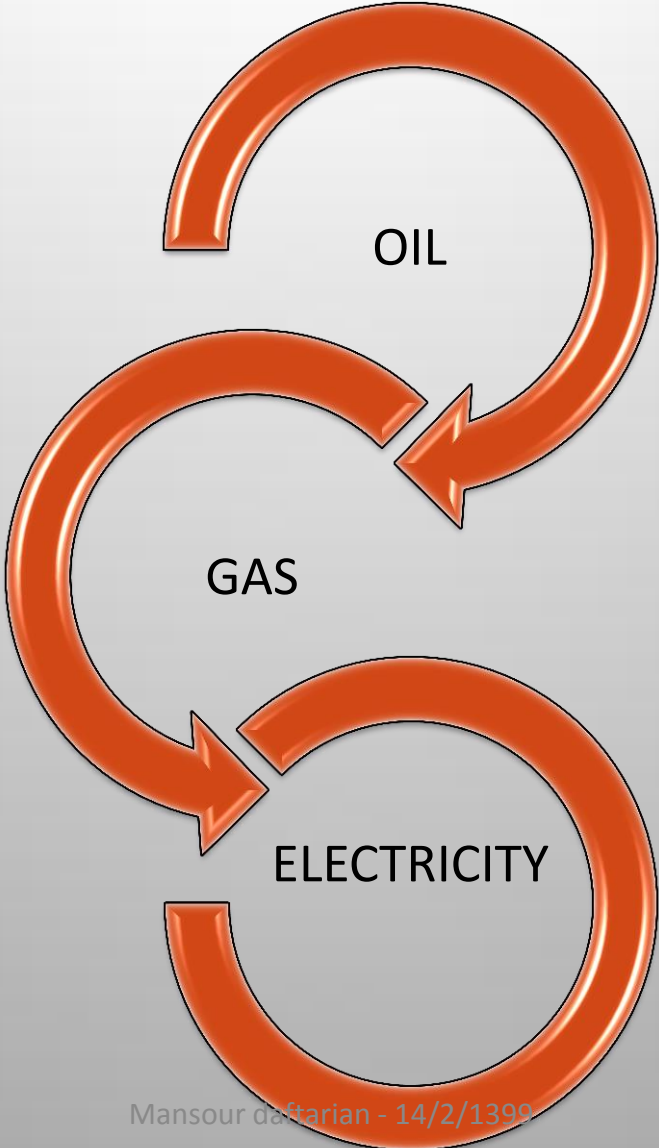


Rice scientists probing the interfacial interactions of polymer (blue) and cement (yellow) discovered the right mix of hydrogen bonds is critical to making strong, tough and ductile composite materials for infrastructure. Computer simulations like that in the illustration measured the strength of the bonds as hard cement slides past the soft polymer in a layered composite, which mimics the structure nacre, seen in the background. Image: Illustration by Probhas Hundi/Multiscale Materials Laboratory

Mansour daftarian - 14/2/1399

Source : https://www.cemag.us/news/2018/01/weak-hydrogen-bonds-provide-strong-tough-infrastructure?et_cid=6247788&et_rid=981770350&location=top&et_cid=6247788&et_rid=981770350&linkid=https%3a%2f%2fwww.cemag.us%2fnews%2f2018%2f01%2fweak-hydrogen-bonds-provide-strong-tough-infrastructure%3fet_cid%3d6247788%26et_rid%3d%26subscriberid%26location%3dtop

ENERGY SUPPLY MANAGEMENT



Science and Technology



It is crucial to fully leverage new technologies and techniques to upgrade our economy.

"There are hundreds of technologies out there that could impact BP, either positively or negatively, and we're constantly scanning to identify and track these"

- *Technology moves so rapidly that new approaches or ideas can emerge – and fade – within short timescales. This is especially evident in the energy world where the evolution of established technologies, coupled with the increasing influence of digital innovation, together with customer demand and government policies, are changing the way companies operate.*

Mansour daftarian - 14/2/1399



Main Design Parameters

Economy of Scale

Layout Optimization

UPGRADING OIL REFINERIES



OPTIMIZE THE OPERATION AND THE THROUGHPUT OF YOUR GAS TRANSMISSION

ASCERTAIN ROOMS FOR IMPROVEMENT

BENCHMARKING

UPGRADING