British Plastics Federation

PLASTICS CONSULTANCY NETWORK

impact solutions
independent plastic experts

Plastics: Understand their Properties and Focus on their Sustainable Use and Applications

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Athens, Greece

Twitter = @ImpactSol

Plastic Testing Research and Innovations:

Types, testing and standardisation.

BP Chemicals → Impact Solutions

- Globally unique plastic experts
- Founded in 2002 Based in Grangemouth, UK
- ISO17025 laboratory with UKAS accreditation & a European notified body
- Research and Development projects

Working across the Plastic Life Cycle

- Exposure and expertise across the plastic industry
- Find solutions to a wide range of industry problems
- Clients from small SMEs to large multinationals

Innovations in Plastic Recycling

baffled oscillation separation system

Quick return on investment

Large increase in selling price of your plastic!

Low capital cost and operational cost

Uses water only. Works with English and Scottish water.

No density controlled liquids, or expensive density control.

Separate difficult feedstock, including mixed polyolefins

90/10 pure Polyethylene and Polypropylene outputs.
100% pure Polyolefin
(other plastics removed in third stream).

Plastic Opportunities

Plastic Pipes:

- For use in Oil, Gas and Water Applications
- Control of Failures and Testing

Biodegradability Testing

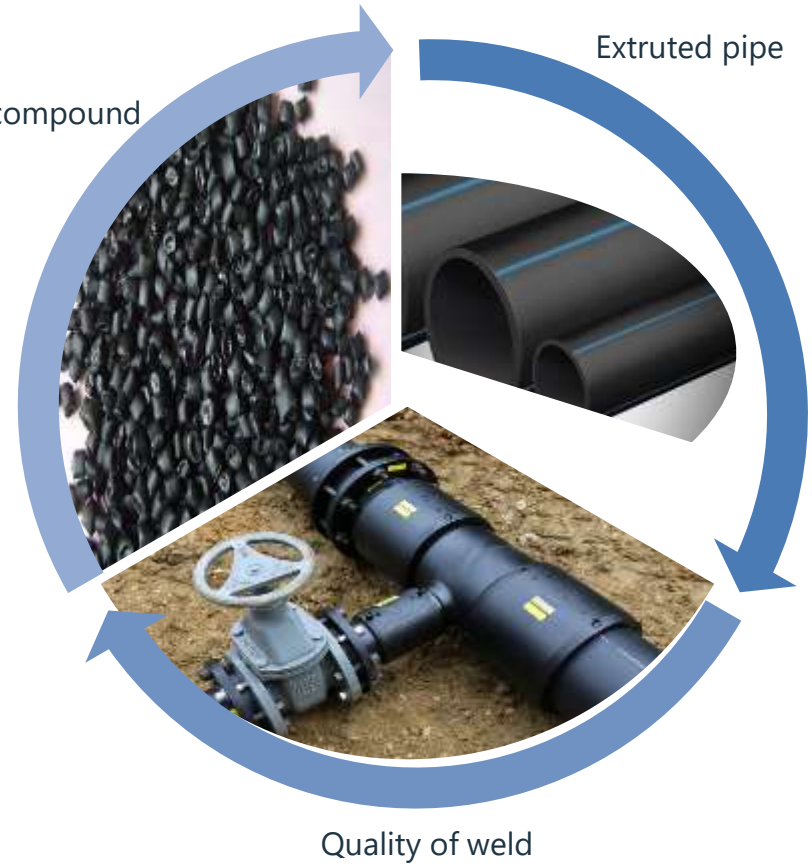
- Expanding biodegradability test labs
- Team of polymer scientists, chemists and engineers
- Work closely with researchers and universities for new tests

Plastic Pipes in Water and Gas Installations

- Plastic pipes have proven to be excellent alternatives to metal and steel: lighter, more reliable, don’t rust and relative cheaper
- The use of PE80 and PE100 pipes has been increased dramatically over the last 30 years
- Although a lot of research has been made in the production of PE pipe materials, bad QA/QC processes can threaten the pipelines
- Pipe manufacturers, Contractors and Utility Companies must establish tight QA/QC procedures and follow the requirements of the relevant standards depending on the application

Quality Control of Plastic Pipelines

The performance of the PE pipelines is depended on the quality and the specifications of the:



- There are various standards which regulate the characteristics of the materials depending on each application and geographical position
- We will focus on the UK water industry standards:

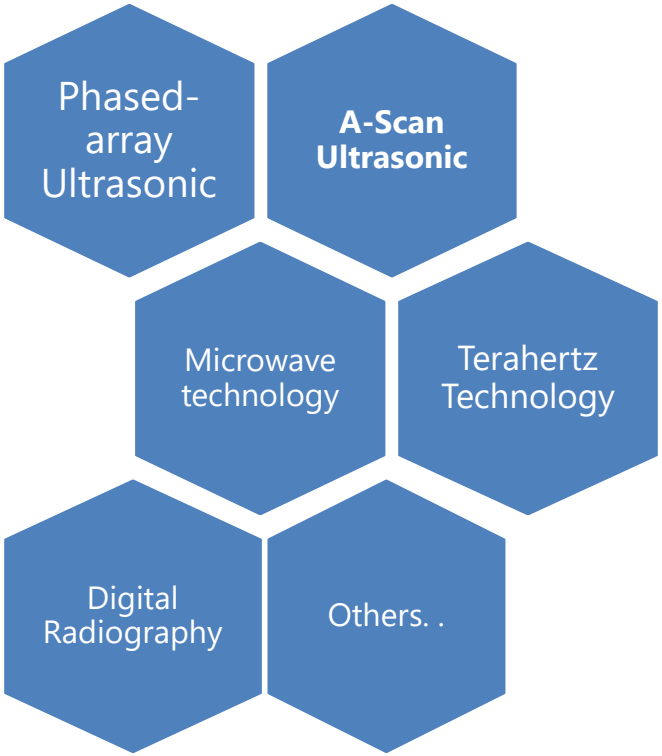
WIS 4-32-08v4, BS EN 12201

Quality Assurance in Pipe Welds

- The most critical and vulnerable part of the pipeline
- Even if the pipes and the materials are OK.. Bad welding can cause catastrophic failures

3.3 BILLION litres of water lost from pipes only in the UK(!)…every day..

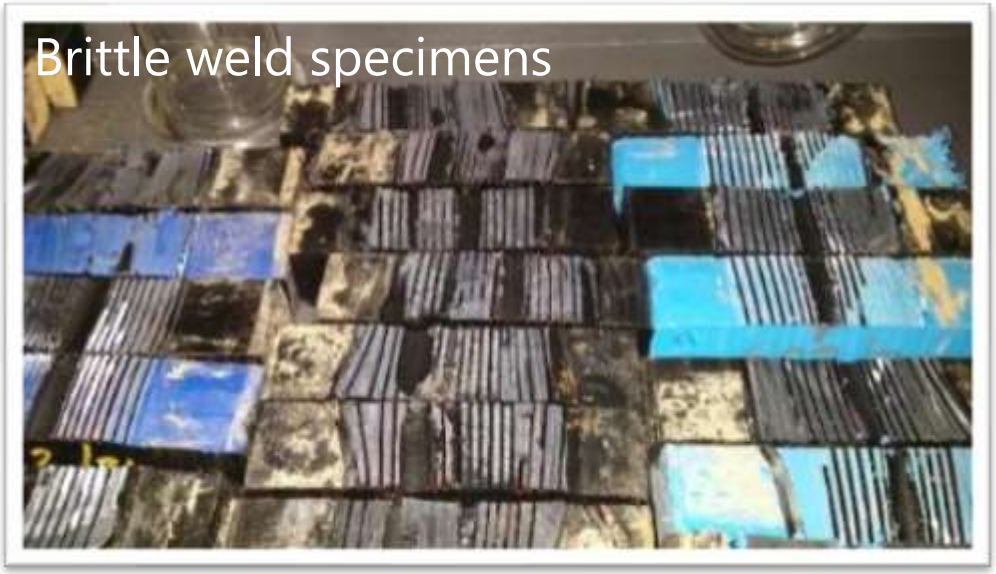
NDT Systems for a full QA control



- A series of NDT techniques have been developed or under development to assess the integrity of PE welds
- These techniques can identify potential flaws in the weld such as: voids, contamination, misalignment, lack of fusion etc.
- **Better correlation between the NDT results and the critical flaws is needed to establish acceptance test criteria**
- What the Industry needs is a method to test joints in real time before infilling and at scale

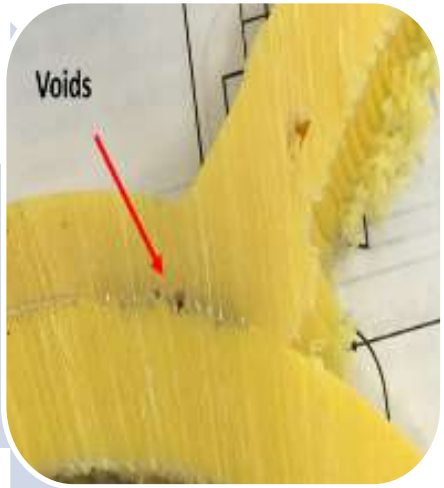
Case Study 1: Water and Gas Main Installation in Large Factory: The Challenge

- In November 2013 a new fire and sprinkler main was installed at a large Factory in North east of England
- After 12 months three failures had occurred in the installation
- The last failure resulted in the Factory close down with £20K loss per MINUTE
- **The failures occurred due to poor QA/QC procedures.**
- Bad EF joints were one of the main cause of failures
- The Contractor had to abandon the recently built water main and install a new one
- The Gas main was also replaced



Case study 2: NDT in PE Gas Pipe Installations

- Following the Successful NYSEARCH trial, a large utility gas company implanted A-scan Ultrasonics to their EF coupler and tapping tees
- Half of the TT inspected with NDT marked as critical due to voiding
- The contractors cut the failed TT for further inspection
- Voids were identified at the “Red” NDT positions



- These voids also caused the pipeline to fail the pressure tests!
- Further investigation revealed that the clamping methods of specific welders caused the voids
- NDT was the only method to identify the defects
- Utility Company has changed their QA and operation procedures and use NDT also to assess the welders

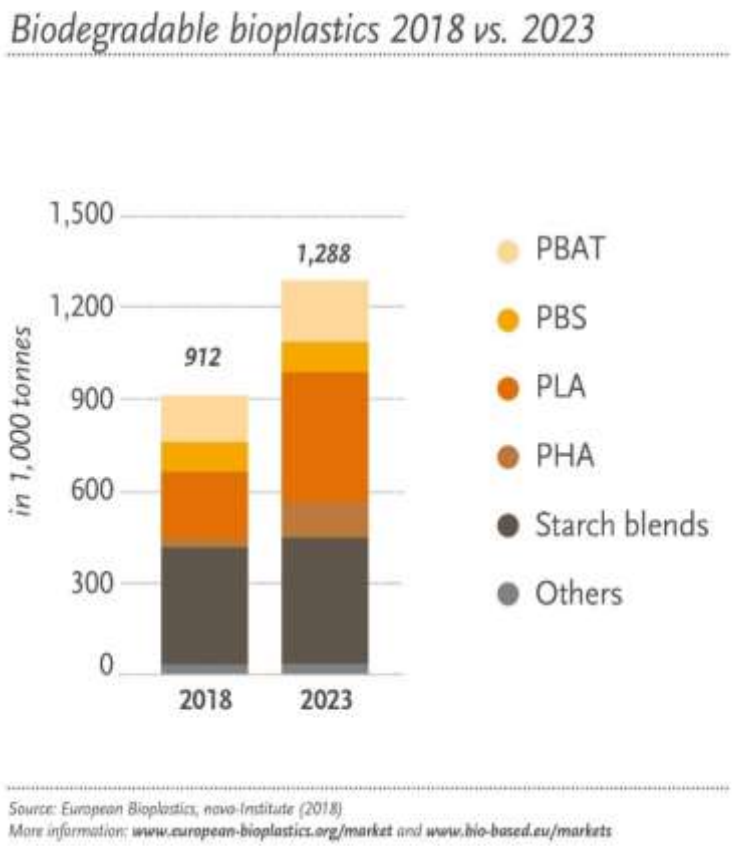
Single Use Plastic and Packaging

Biodegradability Testing

- Expanding biodegradability test labs
- Team of polymer scientists, chemists and engineers
- Work closely with researchers and universities for new tests

Why Biodegradables?

- Plastics have made a huge impact to society: reduced carbon emissions, low weight materials…
- Waste-management is currently a priority for policymakers
- Product design for end of its life
- Many single-use plastic applications



Types of Biodegradable Polymers

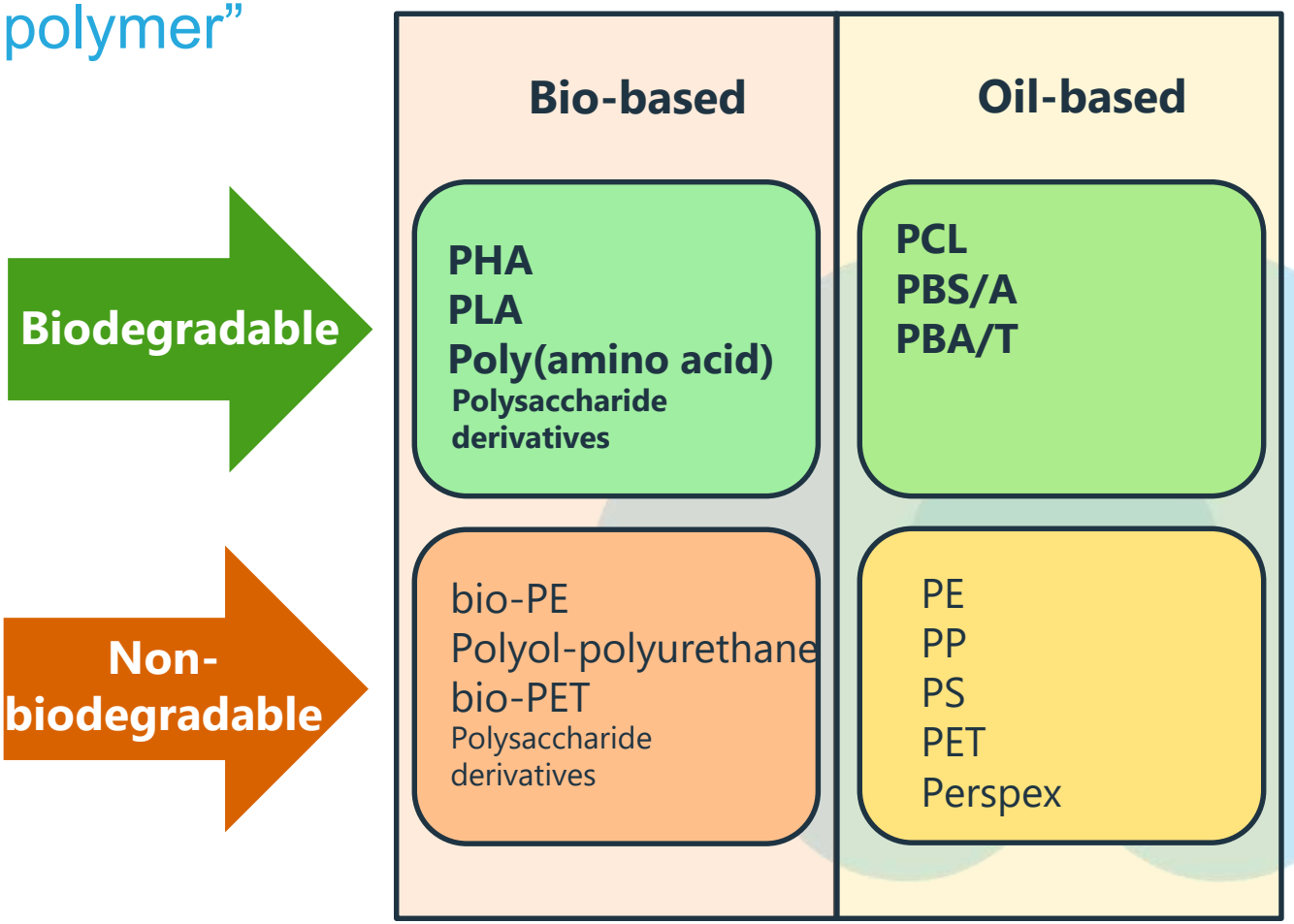
"Biodegradable"

"Oxo-degradable"

"Compostable"

"Bio-polymer"

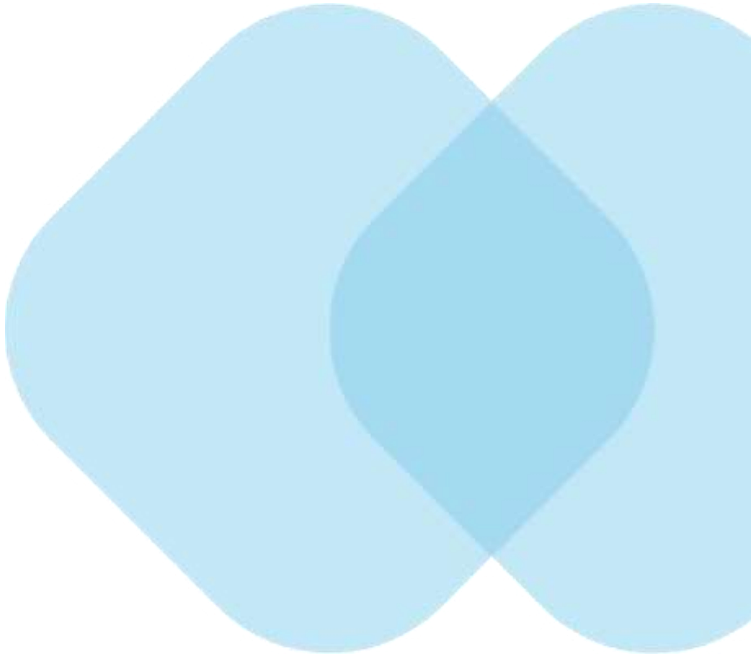
In this presentation we will concentrate on fully biodegradable polymers rather than 'oxo-degradables'.



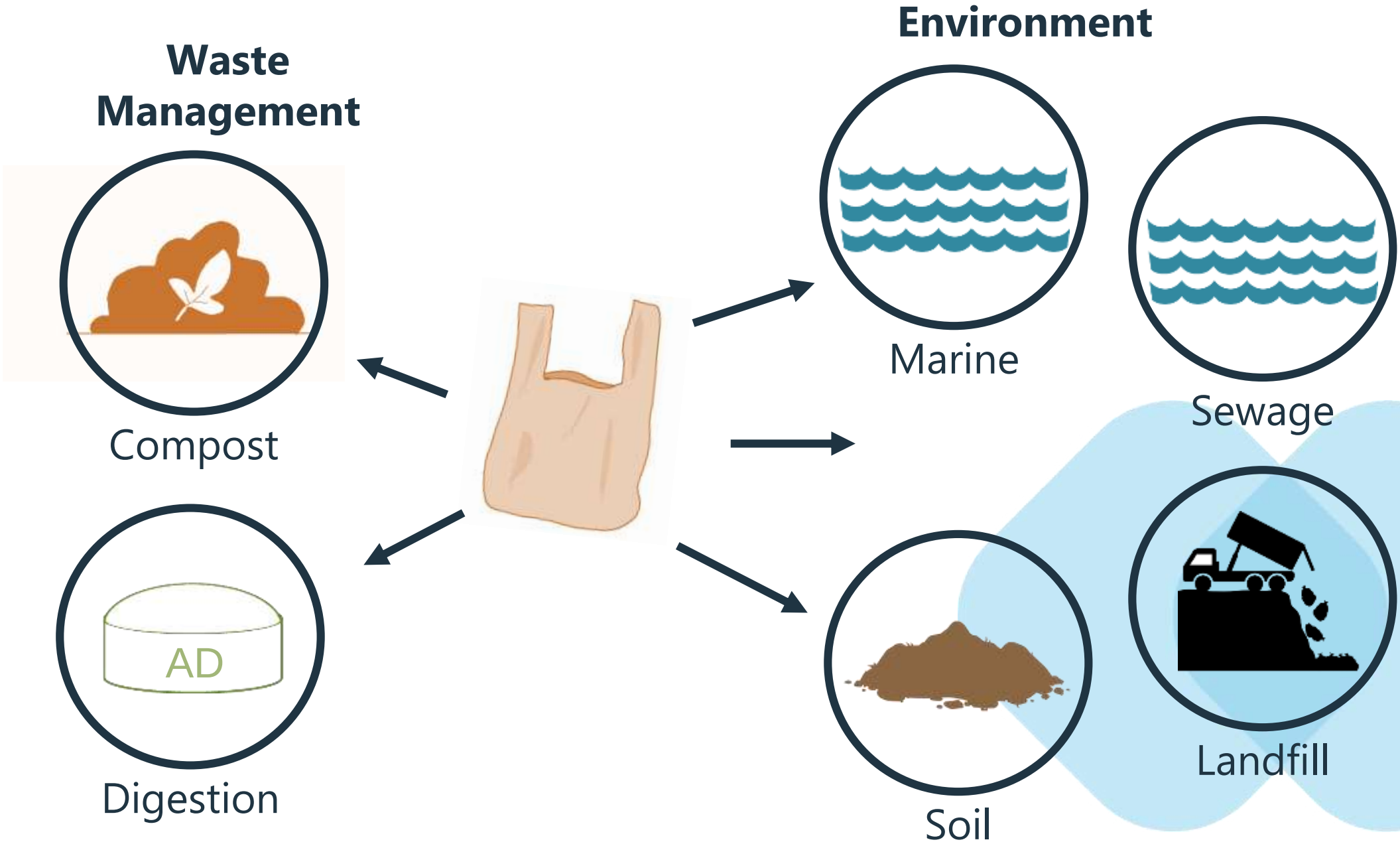
Biodegradable Classification

Whether or not a product can be classed as commercially biodegradable depends on a number of factors including:

- **Type of polymer**
- **Additives and derivatives**
- **Rate** of biodegradation
- **Extent** of biodegradation
- **Conditions** at end of life



End of Life: Final Destination



Where to start?

BS EN 13432 – Plastic Packaging

or

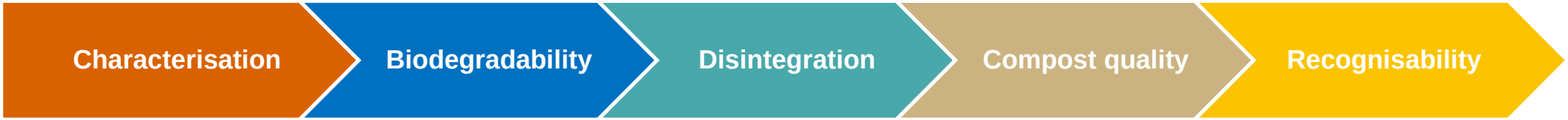
BS EN 14995 – All Plastic

BS EN 13432 - Biodegradable Packaging

Packaging — Requirements for packaging recoverable through composting and biodegradation — Test scheme and evaluation criteria for the final acceptance of packaging

Compost - Packaging

BS EN 13432 - Biodegradable Packaging



BS EN 13432 - Biodegradable Packaging

Characterisation | Biodegradability | Disintegration | Compost quality | Recognisability

- Infrared spectroscopy
- XRF, ICP

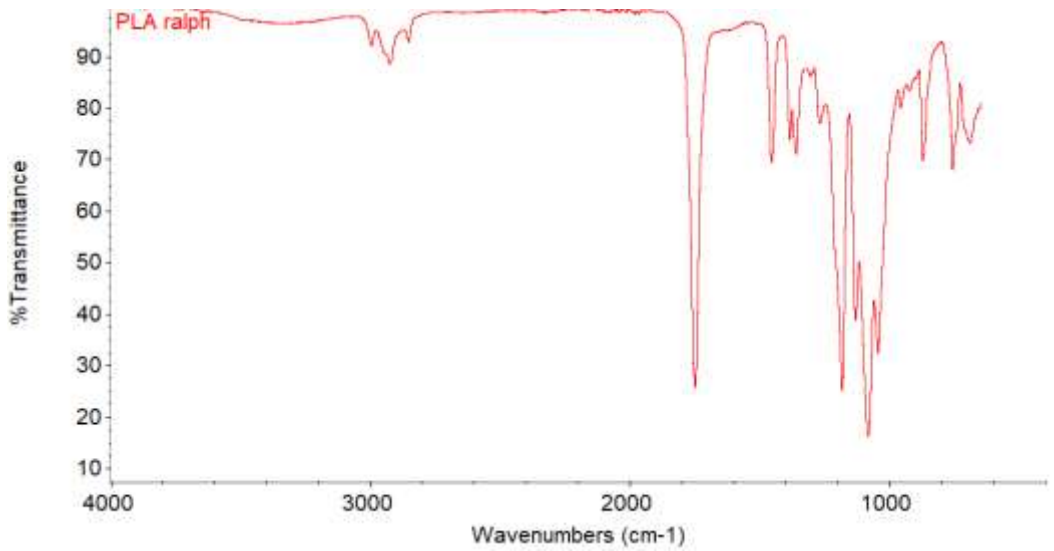


Table A.1 - Maximum element content of packaging material and whole packaging

Element	mg/kg on dry substance	Element	mg/kg on dry substance
Zn	150	Cr	50
Cu	50	Mo	1
Ni	25,0	Se	0,75
Cd	0,5	As	5
Pb	50	F	100
Hg	0,5		

BS EN 13432 - Biodegradable Packaging

Characterisation | **Biodegradability** | Disintegration | Compost quality | Recognisability

- Choose appropriate test standard
- Material test
- Gas evolution – volumetric or by mass
- Different standards for anaerobic and aerobic

Aerobic

e.g. ISO 14855
ISO14851
ISO 14852
D5338

Anaerobic

e.g. ISO 15985
ISO 14853
EN ISO 11734
D5511

BS EN 13432 - Biodegradable Packaging

Characterisation | Biodegradability | **Disintegration** | Compost quality | Recognisability

- Whole product test
- Within specified treatment time

"The physical falling apart into very small fragments of packaging and packaging materials"

Standards:
- ISO 16929
- EN 14045
- ISO 20200

→ 12 weeks
2 mm sieve
-> % disintegration

BS EN 13432 - Biodegradable Packaging

Characterisation | Biodegradability | Disintegration | **Compost quality** | Recognisability

- Heavy-metal testing
- Physico-chemical characteristics
- Plant growth test – OECD 208

"the quality of compost produced is not negatively affected"

"Fast Plant Growth Study" By Jeff Peterson is licensed under CC BY 2.0.

BS EN 13432 - Biodegradable Packaging

Characterisation | Biodegradability | Disintegration | Compost quality | **Recognisability**

Labelling

- Recognisability is key feature of the standard EN 13432
- Consumers need to know how to dispose of products in order for biodegradability to be relevant

Don’t Give Up on Plastics

- **Reduce, Reuse and Recycle**
- **single-use Plastics: Biodegradables?**

Plastics in Oil and Gas: Alternative to Steel Pipes

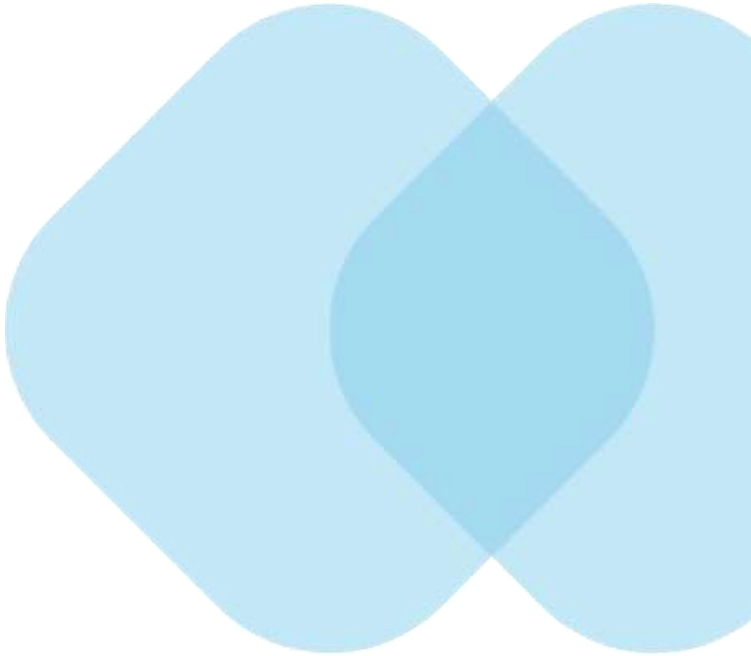
•Rustproof, break-resistant and corrosion-free.

•**withstand harsh chemical environments.**

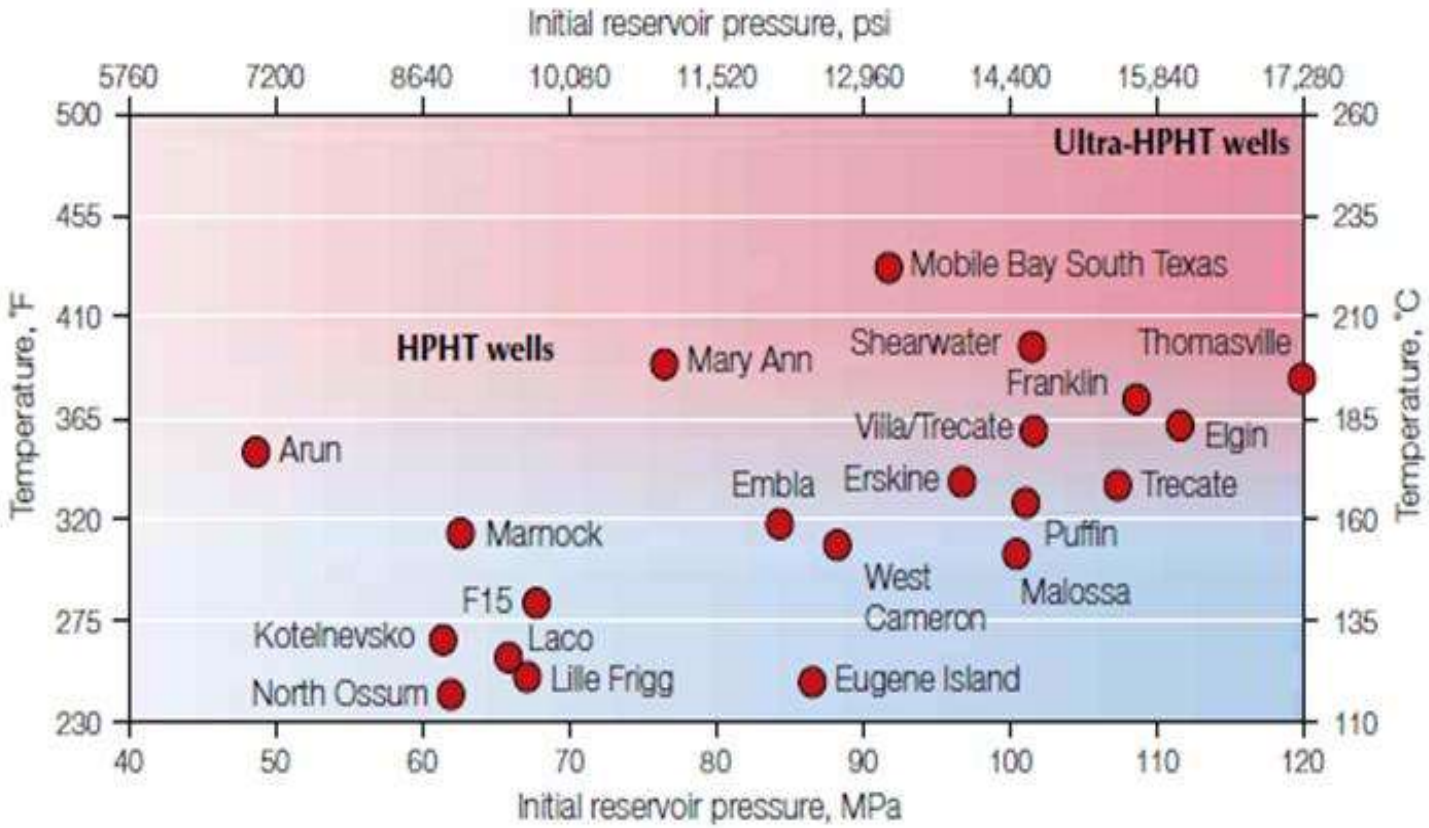
•semi-rigid to withstand high external loads. Its flexible nature expands with pressure surges that increases the life of the pipeline.

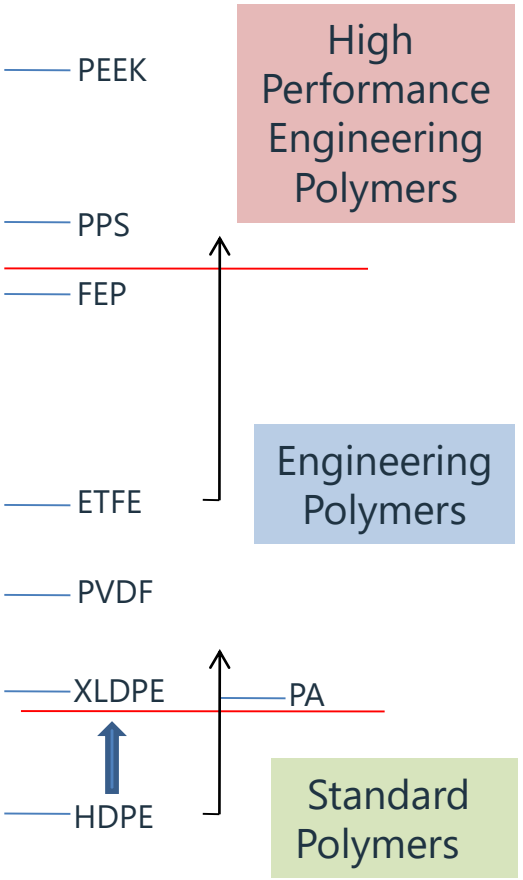
•pipe installations have long term cost advantages due to its physical properties, leak-free joints and reduced maintenance costs.

•**The service life for PE pipe is an estimated 50-100 years**



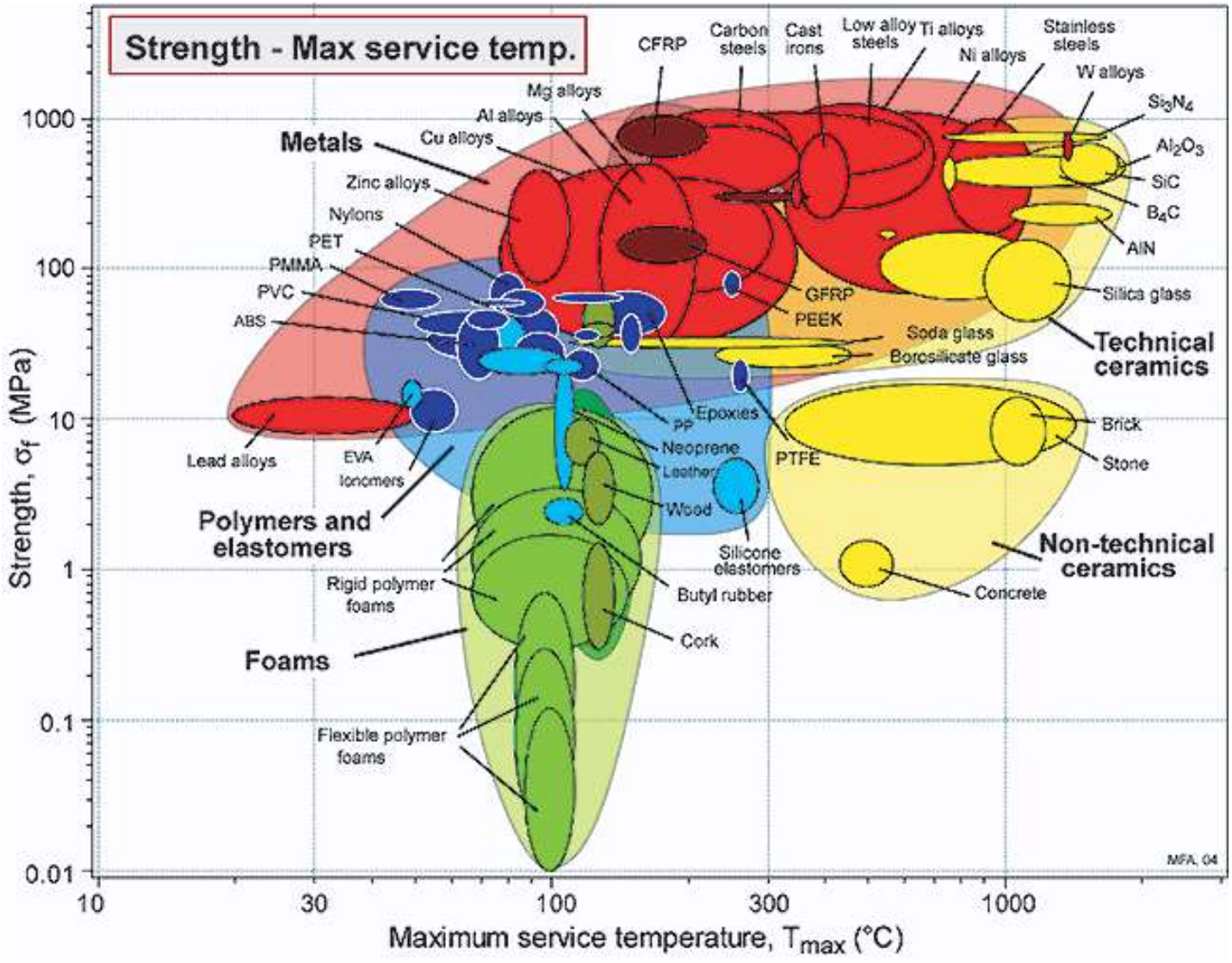
High Pressure High Temperature Oil Fields





HPHT fields. The number of HPHT wells is growing worldwide. Wells with undisturbed bottomhole temperatures above 150°C [302°F] are classed as high temperature. Those with wellhead pressure greater than 10,000 psi [69 MPa] or a maximum anticipated downhole pore pressure exceeding an 0.8 psi/ft [18 kPa/m] hydrostatic gradient are considered high pressure. Wells with bottomhole temperatures above 425°F and pressures above 15,000 psi [103 MPa] are generally regarded as ultra-HPHT.

Strength of polymers v other materials



Typical Subsea Polymers

	Strength	Temp	Impact resistance	Friction	Cost
PEEK	High	High	Med	Med	$$$$$$
PTFE	v Low	High	n/a	V Low	$$$
PA 6	High	Med	Med	V Low*	$$
POM-C	Med	Med	Med	Med	$$
PP	Low	Med	Med	Med	$
HDPE	Low	Med	High	Med	$

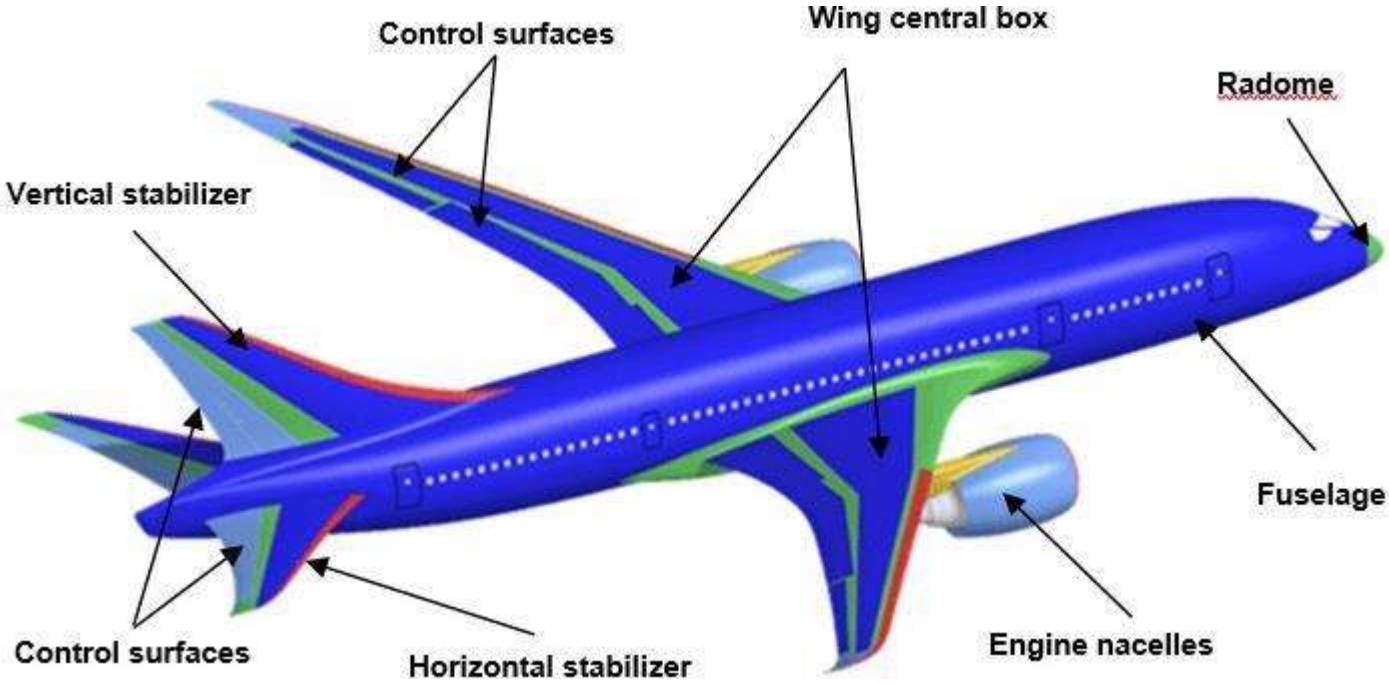
Source: Nylacast

* PA 6 Lubricated formulation

Thank you for listening

www.impact-solutions.co.uk/biodegradable-plastic

Twitter: @ImpactSol


Control surfaces
Wing central box
Radome
Vertical stabilizer
Fuselage
Control surfaces
Horizontal stabilizer
Engine nacelles