A laser to recycle all types of glass

Not all glass is recyclable. Dianna Bautista* discusses a project which aims to develop laser technology to recycle contaminated glass into new products.

Everglass Consortium at the University of Vigo, Spain during the project's launch.

Even though the glass industry is investing heavily in designing breakthrough technologies and increasing glass recycling, glass production is a carbon and energy intensive process.

Much of this comes from from the combustion of natural gas used for melting (approximately 80% of its CO_2 emissions).

The remaining 20% comes from virgin raw materials (carbonates decompose in the furnace and release CO_2).

Glass is the most suitable material for reducing these energy-intensive demands. It is a permanent material. It can be recycled over and over again, without losing its physical properties.

"Recycling is actually one of the main decarbonisation pathways for the sector," notes Iva Ganev, Environment and Climate Policy Manager for Glass for Europe, the trade association for Europe's flat glass sector.

Recycling

Recycling glass involves collecting and sorting glass waste.

Glass is then crushed and combined to produce a granular material, called cullet.

The cullet is added to a furnace where it is melted together with virgin raw materials of sand, soda and limestone to produce glass.

Since cullet melts at a lower temperature than the raw materials, adding them to the batch reduces energy consumption and carbon emissions while saving raw materials.

Collection and recycling of used glass containers began in Europe in the 1970s as a voluntary initiative by the glass industry.

"Today recycled glass is the most important raw material used in container glass production, representing on average more than 50% of the batch," says Vanessa Chesnot, Head of Public Affairs & Product Policy at FEVE, the European Container Glass Federation. Within Europe the current rate of collection is above 80%, with rates differing from one country to another.

Ms Chesnot co-ordinates Close the Glass Loop, a European initiative aimed at increasing the European average recycling rate to 90% by 2030. The initiative involves collaboration along the glass packaging value chain.

She has closely followed European efforts to increase glass recycling: "The container glass industry is strongly committed to decarbonisation and many paths are being explored and deployed. Increasing recycled glass uptake is one of these paths.

"This has been a priority for container glass manufacturers for decades."

Technical challenges

However, despite most container glass being collected, sorted and recycled, certain types of glass are not being recycled to their potential capacity.

Much of the current glass recycling infrastructure is designed for packaging (usually sodalime slicia) glass, such as beverage bottles or food jars.

Non-packaging glass usually has a different chemical composition and must be collected and recycled separately and within their own production streams.

Electronic screens, glass fibres, and borosilicate or heat resistant items are some examples of such glasses.

If melted with sodalime silicia glass, they can affect the melting conditions or potentially introduce contaminates.

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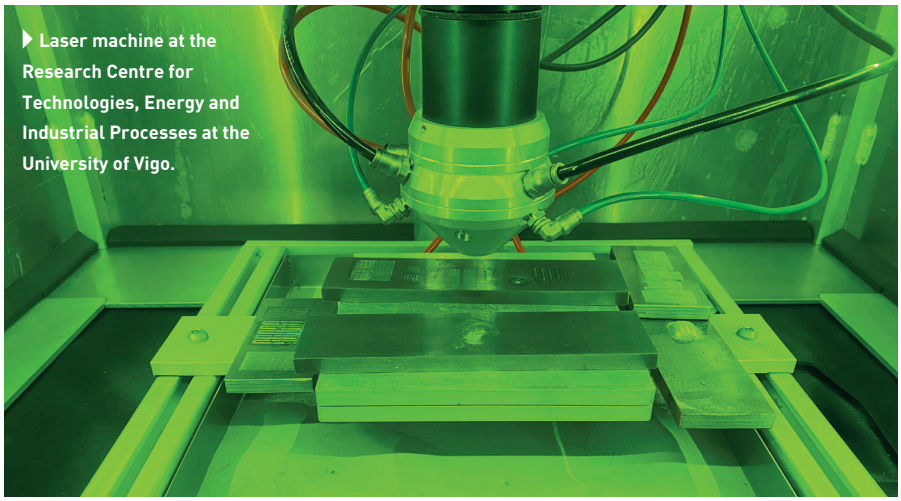

Laser machine at the Research Centre for Technologies, Energy and Industrial Processes at the University of Vigo.

They need their own production and recycling installations to suit their needs. This requires technical and infrastructural support, which can be lacking depending on the specific glass subsector.

Obstacles

For other glasses, the obstacles can occur at the collection and sorting stage.

Flat glass refers to the windows, doors, and other sheet glass from buildings and automobiles. Dismantled buildings are potential sources of recycled flat glass, yet from a demolished building, only a small portion of the windows are well preserved and separated. Often the window is still in its frame. If the window and frame are then shredded together, the result is glass mixed with containments such as plastic, wood, aluminium. This is not usable for cullet and can potentially ruin a whole batch of melted glass.

Contamination

For flat glass, the purity of the final product is important, since it is pressed into thin, wide sheets after leaving the furnace.

"No contamination whatsoever can be tolerated. The tiniest contamination could provoke bubbles or imperfections which would actually break the glass.

"And obviously you cannot have that neither in a window nor in a windshield for a car, because it would cause safety issues," says Ms Ganev. "There is strict control of the whole process and the quality of the final glass."

Glass for Europe aims to improve the collection and sorting steps by advocating for audits and policy that encourage separation of glass during deconstruction. They also aim to improve the current use of cullets to further decrease CO_2 emissions and energy usage.

Within the flat glass sector, cullets account for 26% of the materials used in the flat glass melting process. The remaining percentage of flat glass is used either to produce other types of glass or is lost to landfills.

Increasing the cullet percentage to 37%, can reduce CO_2 emissions by 7%.

Purity

Similarly, contamination is also a challenge for recycling pharmaceuticals.

"In the pharmaceutical class, purity and high quality of the product is critical," notes Dušan Galusek, the Director of the FunGlass Centre in Slovakia.

"It can actually affect the content. It can damage the drugs which are stored inside and of course threaten human health."

When glass items are not recycled, they end up in landfill where their raw materials are lost.

"You lose these materials forever," says Prof. Galusek.

Prof. Galusek is part of Everglass, an EU-funded research project that aims to develop new glass recycling technology.

The project seeks to improve the current state of this industry, with a focus on infrastructure and technical limitations.

They aim to introduce novel technology that would take glass waste and use laser technology to 3-D print new glass. The proposed technology will involve assessing the properties of glass waste and conditioning said glass so that it can be converted into a glass powder.

The glass powder will be input into the project's prototype, where a laser morphing process will produce the new glass. The cycle can be repeated with new glass waste, thus allowing for infinite recycling of the glass, regardless of the type.

The project's technology could increase accessibility of glass recycling in places with limited capacity.

For example, in communities where the collection of a recyclable glass is more difficult because of transportation and the amount of glass collected.

Though glass recycling might not be the first thought for a sustainable future, it is an integral part. It protects humanity and society from further environmental damage. And as Prof. Galusek concludes: "Whatever we do, nature and the environment will always survive, but the question is whether it will be here with humans or without them."■

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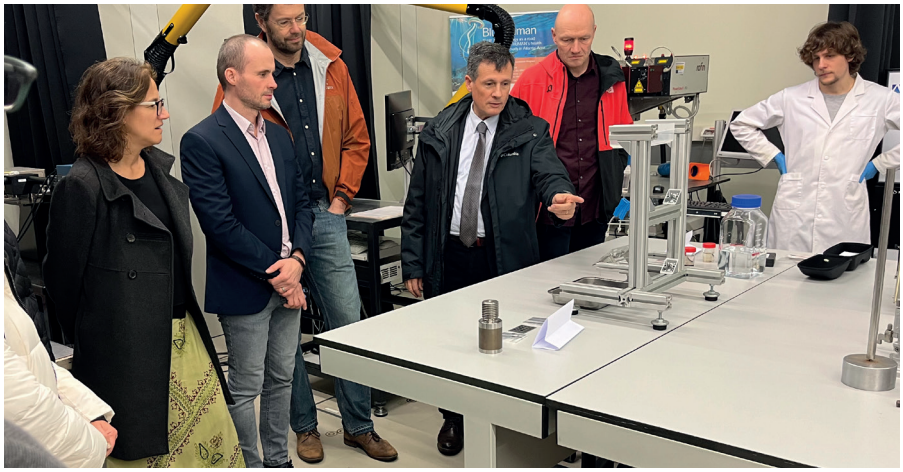
https://www.everglassproject.eu/



Everglass Project Co-ordinator, Juan Pou, giving a tour on the Research Centre for Technologies, Energy and Industrial Processes at the University of Vigo.