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Decarbonising the U.S. energy system by accelerating innovation

Carbon Capture Coalition policy blueprint to accelerate CCS

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2021 will be 'year to remember' for CCUS deployment in UK and EU

CCS to create blue hydrogen from natural gas – Zero Carbon Humber

Equinor's progress with Longship and Baker Hughes' CO2 capture business

O.C.O Technology working on new mineralisation opportunities

Having comercialised a versatile process that uses carbon dioxide as a resource to treat a wide range of wastes while permanently capturing the CO2, O.C.O. Technology is now working on a trial with Mitsubishi on the carbonation of slag waste from a steel processing plant.

UK-based O.C.O Technology is used to achieving world-firsts.

It has led the way in commercialising its Accelerated Carbonation Technology (ACT) process, treating Air Pollution Control residues (APCr) from the Energy from Waste (EfW) sector with waste carbon dioxide gas to enable the permanent capture of significant amounts of CO2.

It was the first to manufacture a truly carbon negative artificial aggregate – known as Manufactured LimeStone (M-LS) – on a commercial scale, and its success has been such that in 2011, the UK's Environment Agency granted the product End of Waste (EoW) approval. It was the first time any company in Europe had achieved such an accolade for an APCr waste stream and secured the aggregate's position as a perfect example of the circular economy in action.

Last year, O.C.O produced over 310,000 tonnes of carbon negative aggregate from its three UK operations in Leeds, Avonmouth and Suffolk, a figure that continues to grow as the construction industry seeks to improve its sustainability credentials.

Carbon negative M-LS aggregate from O.C.O Technology is in demand as a sustainable building material

The benefits of Manufactured LimeStone

O.C.O's M-LS is already in demand as a sustainable building material. In 2019, it was estimated that its M-LS BlockMix, specially formulated for use in concrete masonry blocks, was used in well over 25 million blocks – the equivalent to building more than 10,000 three-bedroom homes.

Key benefits:

- Enables capture of significant volumes of CO2
- Demonstrates the circular economy in action
- Contributes to sustainable construction products
- Diverts APCr and other residues from landfill
- Every tonne of M-LS used avoids the quarrying of 1.4 tonnes of natural aggregate

Now however, as the world turns up the heat on the drive towards net zero emissions, O.C.O is using its same proven expertise in carbon capture and the mineralisation of CO2 to look at the potential carbonation of other forms of waste.

To help facilitate this, the company recently secured permit variations at all three of its sites to enable it to handle different types of waste and increase the range of materials authorised for processing.

In early February, trials began at its main R&D laboratory on the carbonation of slag waste from steel processing plants, an innovative new project it is working on with Japan's Mitsubishi Corporation.

It is part of a wider project with Mitsubishi Corporation to assess the opportunity for carbonating new waste materials, and comes after the Japanese giant chose O.C.O as one of only four global companies – and the only one in the UK – to join its Green Concrete Consortium.

Billed as a combination of carbon capture and utilisation (CCU) mineralisation projects, the Consortium's goal is to transform CO2 into carbon negative concrete and aggregates, a move which is enabling the O.C.O team to ramp up development of its technology.

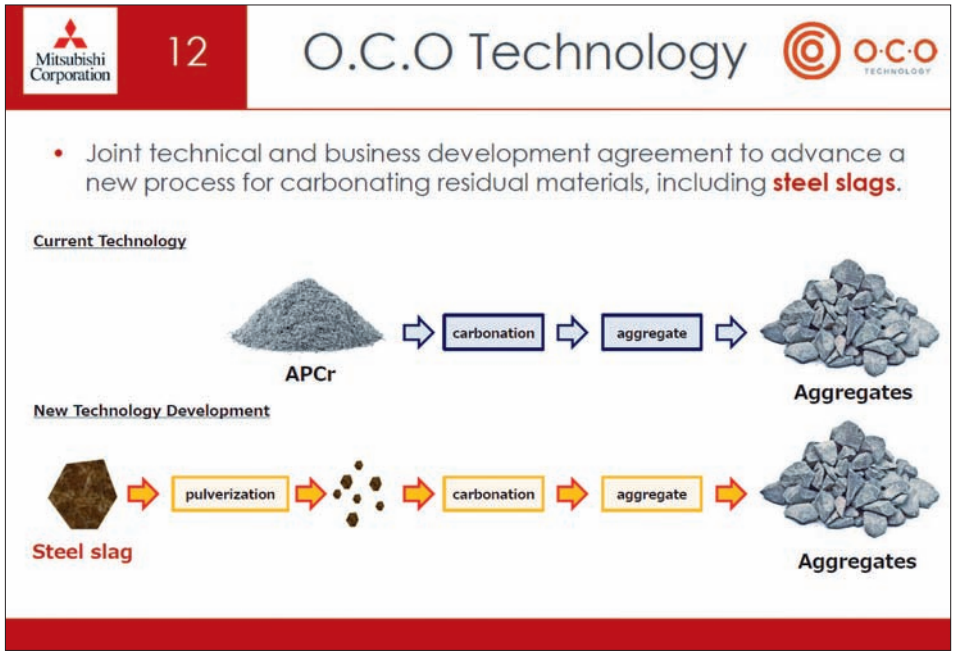
Potential to lock in 140m tonnes of CO2

Dr Peter Gunning, O.C.O's Head of Research & Development, said: "Partnering with Mitsubishi is a fantastic opportunity and gives us the perfect platform to demonstrate the role that carbon capture, through the mineralisation of CO2, can play in combating climate change.

"Around the world, if you look at the materials available to apply this technology, the potential is enormous. Given that just energy recovery, metallurgical processes (such as steel production), biomass, cement manufacture and paper production – produce waste arisings of more than 1 billion tonnes, with the potential to lock in a staggering 240 million tonnes of carbon dioxide. That is a very big number indeed. And there is more potential in other wastes besides".

"There are many carbon-friendly innovative technologies and ideas out there that will hopefully come to fruition. We have the advantage in that our process is tried and tested – we are mineralising the CO2 into solid carbonate and turning it into a stable, solid product that guarantees the carbon remains locked in.

"To our knowledge, although there are other pilot projects working on carbon mineralisation, we don't believe there is anyone else operating commercially on such a large scale as us, and the potential for the new materials we are working on is huge."



The current technology for producing the M-LS from APCr and how the carbonation process will work for steel slag waste – credit Mitsubishi Corporation

Testing

The Japan project combines the expertise of both O.C.O and Mitsubishi Corporation (MC) with another Japanese engineering firm. Work began in 2020 and over the last six months laboratory trials have been taking place in Japan to prepare samples of the slag for the carbonation process.

With the arrival of those samples in the UK, trials are now under way at the main R&D laboratory to understand performance levels and gauge the carbonation potential.

Dr Gunning continues: "This is a very exciting stage of the project, no two materials are alike and of course, this is the first time we have worked with this material, so these tests are critical to the next steps.

"Our ACT process combines the slag with waste CO2 gas and a blend of binders and fillers to create the M-LS. It's much like baking the perfect cake, tweaking the recipe until we have got it just right. Making sure we can meet the rigorous End of Waste specifications."

Once the UK trials are complete, the samples will be sent back to Japan for further chemical and aggregate testing, with the eventual aim of commercialising the process in the same way O.C.O has done for its APCr carbon negative aggregates.

The partnership has been praised by Masao Koyama, manager of Mitsubishi Corporation's Carbon Capture and Utilization (CCU) task force, who says: "We are passionate to work with O.C.O Technology, a company who owns one of the most competitive carbon removal technologies to capture CO2 into waste materials.

"We will continue supporting O.C.O and the project to gather market information and to assist the business development, utilising our global network and knowledge from our existing business including other CCU activities. We are excited to be part of a great partnership which we strongly believe will contribute to prevent our biggest problem climate change."

O.C.O's links with Mitsubishi Corporation have also gone one step further as, in a joint partnership with carbon project developer South Pole, its carbon capture technology has been submitted in response to Microsoft's Request for Proposals (RFP) as the technology giant searches for carbon removal projects.

If the proposal by South Pole is successful, it is hoped that O.C.O's Leeds facility will become a recognised carbon credit offset option for Microsoft. The verification procedures for the Microsoft bid, together with yet to be announced new initiatives in carbon credit trading, will allow the Mitsubishi Corporation / South Pole / O.C.O partnership to offer carbon credits to other companies keen to offset their carbon emissions.

Biomass APCr

Closer to home, O.C.O has been extending its reach into the biomass sector.

In 2020, the company began working with Tilbury Green Power (TGP), which wanted to find a circular economy solution for APCr from its waste wood powered renewable energy facility.

Previously, O.C.O had been predominantly using its technology in the municipal waste EfW sector, where customers include Grundon Waste Management, Viridor, and the Ferrybridge Multifuel 2 (FM2) power station in Yorkshire operated by SSE.

But because biomass APCr has different characteristics to municipal waste EfW APCr, O.C.O's in-house team of chemists needed to carry out rigorous trials to ensure the aggregate would still be 100% compliant with the End of Waste specification.

Dr Gunning says it is just one example of how

the company's track record of expertise and experience enables it to respond quickly and effectively to new challenges within the marketplace.

In 2019, the equivalent of 11,695 tonnes of M-LS was made with biomass APCr and in 2020 that had more than doubled to 24,090 tonnes – around 6.5% of the total waste O.C.O handles annually.

A more 'harmonised' approach is needed to EoW

Alongside its work in Japan, O.C.O is also working on projects in Australia and, with an increased focus on utilising carbon capture technologies to help meet carbon zero targets worldwide, Dr Gunning says he feels real hope for the future.

"Today's younger generation understand far more about recycling and reuse of materials but I believe a wider change is needed on a global scale," he said.

"We are now beginning to see governments unlocking more funding for carbon friendly technologies and I would like to see more of that happening at a faster pace. However, that must come hand-in-hand with a more forward-thinking approach towards the development of End of Waste mechanisms and the certification of products valorised from waste".

"There can still be a perception that products derived from waste are in some way inferior and that needs addressing – it is improving – but while some countries have embraced the concept of the circular economy and End of Waste certification, others are still inclined to dismiss it completely or haven't yet implemented the mechanics to make it happen.

Dr Peter Gunning is pictured in the laboratory at O.C.O Technology's Avonmouth facility

"I believe the UK's Environment Agency has been at the front of the EoW curve. We have this fantastic proven technology at our fingertips, but it's not as simple as taking that portfolio of information and giving it to the necessary authorities in other countries – you have to start the process all over again.

"Right now, regulation is the biggest sticking point, if we can get to a more harmonised approach with a wider recognition of a global market for these technologies and the huge potential for carbon capture in the fight against climate change, then we can all truly make a difference."

More information

www.oco.co.uk