



New process for efficient CO₂ capture by innovative adsorbents based on modified carbon nanotubes and MOF materials modified carbon nanotubes



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Dear reader, the CARMOF project would like to share some updates with you in this newsletter. The CARMOF project develops Carbon Capture and Storage (CCS) technologies that make carbon capture efficient and cost-effective by the use of innovative CO₂ adsorbing materials at nanoscale (such as CNTs and MOFs) and 3D print them or make them into membranes for use in larger adsorbing units. The project is currently half-way, having started in January 2018, and is funded under the European Commission's Horizon 2020 research and innovation programme.

Promethean Launches New MOFs in Response to Climate Change Challenge

Promethean Particles, a pioneer in the development of high specification nanotechnologies, has launched a new range of **Metal Organic Frameworks (MOFs)**, which address the challenges posed by climate change by **adsorbing CO₂** from the world's atmosphere. They have the world's largest continuous multi-material nanoparticle manufacturing plant meaning tonnes instead of kilograms of material can be produced. This enables significant cost reduction per unit of material.

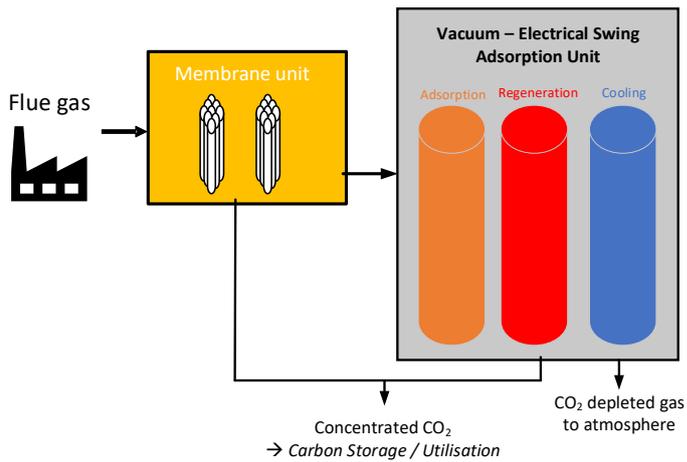


CPO-27(Ni) MOF powder developed in the CARMOF project and now commercially available from Promethean Particles

Enhanced Carbon Capture using Membrane Technology

In the CARMOF project a novel **hybrid membrane/sorption unit** will be developed comprising of a two-stage membrane system and a **3D-printed sorbent**. The low energy two-stage membrane unit will be a series of, firstly a high permeance hollow fiber polymeric membrane and, secondly, a higher CO₂ selectivity, lower permeability membrane containing CNTs.

The membrane unit has a flue gas treatment capacity of up to 1100 L/min, which corresponds to more than 500 kg CO₂/day for a flue gas with 17% vol CO₂ (as in the Motor Oil case, see next section).



CARMOF Hybrid CO₂ Sorption Unit



Testing of the membrane module for CO₂ capture from flue gas at DEMOKRITOS and SUK facilities

Industrial Carbon Capture Demonstrators

The Carbon Capture technology, developed by the CARMOF project, will be demonstrated at industrial scale by the installation and operation of two Pilot Units, one in the Petroleum Refinery of MOTOR OIL HELLAS (Greece) and one in the Kamari Cement Plant (Greece) of TITAN Cement Group.

The Pilot Unit in **MOTOR OIL's Petroleum Refinery** will be installed next to its Hydrogen Production Unit. This Unit is producing hydrogen through stream reforming of either natural gas, liquefied petroleum gas or naphtha. Its design production capacity is 65.000 Nm³/h H₂ with a purity of at least 99.9% vol. The flue gases of the Hydrogen Production Unit contain on average 17% vol CO₂ with a flow rate of 160.000 Nm³/hour. The Carbon Capture demonstrator will have a capturing capacity of 350 tonnes CO₂/year. The CARMOF Pilot Unit will be built in line with EU safety recommendations and MOTOR OIL's Health, Safety and Environment requirements (lead partner: SUK, Greece). Its sensing and automation will allow its complete control and remote monitoring (lead partner: 6TMIC Ingénieries, France).



Motor Oil (Hellas) Industrial Plant



Motor Oil (Hellas) Hydrogen Production Unit

Cement, the most used building material on earth, is produced through an energy intensive process associated with significant emissions of carbon dioxide. Improving the environmental footprint of products and operations is among the key priorities for **TITAN Cement Group**. TITAN is actively fostering innovative approaches for the reduction of CO₂ emissions, while proactively building its knowledge and operational readiness for Carbon Capture and Utilization (CCU) technologies, as reflected through the active participation in the CARMOF project. The CARMOF demonstration unit will be installed at the TITAN Kamari cement plant in Athens, Greece, treating up to 250kg of CO₂ per day. Operating the demonstration unit with actual flue gas, under industrial conditions is expected to yield crucial information to support the implementation of CCU in cement manufacturing.



Titan Cement Group, Kamari Cement Plant

Want to know more about the project?



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