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Innovative CO2 to CO Conversion Technology for Carbon Neutrality with High Reaction Yield and Economic Efficiency

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Sekisui Chemical has been developing technologies to efficiently convert **CO2 to CO with Reverse Water Gas Shift (RWGS) reaction by Chemical Looping(CL).**
Among the various CO2 utilization approaches, RWGS reaction plays a pivotal role since it produces synthesis gas (CO + H2), the building block of numerous conversion processes. However, average CO generation yields are ~40-50% with conventional RWGS which limits efficient CO2 reduction. Introduction of metal oxide as an **Oxygen Storage Material (OSM) would bring RWGS reaction further by splitting the reaction itself into a reduction and oxidation reaction, referred to as a RWGS-CL, an intensified RWGS.** By switching the gas flow between at least two reactors after the OSM is reduced or oxidised, respectively, a quasi-continuous process can be achieved, which is more efficient compared to the classical RWGS as it yields partially separated gas streams, simplifying the downstream gas separation. The CL technology developed by Sekisui has **validated >90% CO reaction yield and 80% H2 conversion at bench-scale demonstration with ArcelorMittal using blast furnace gas in Spain for 6months in total.** This achievement is a result of NEDO's international joint research and development project (JPNP20005) in the field of clean energy. Pilot demonstration with ArcelorMittal is now planned in combination with further CO valorization technologies.
In Japan, Sekisui Chemical has launched a demonstration project to produce high-performance chemicals by combining this RWGS-CL technology with the downstream bio-process using CO2 from waste incineration plants, and plans to start a sales business in 2030 (JPNP22010).
In addition, Sekisui Chemical has selected to DoE project in U.S.A. to demonstrate CO2-derived graphite electrode production, with Nucor, Tokai Carbon, and Seerstone development (DoE-FoA-2997).
By applying the RWGS-CL technology to CO2-containing waste gas in steelmaking process, Sekisui hopes to contribute to CCU and decarbonization in steel plants.

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