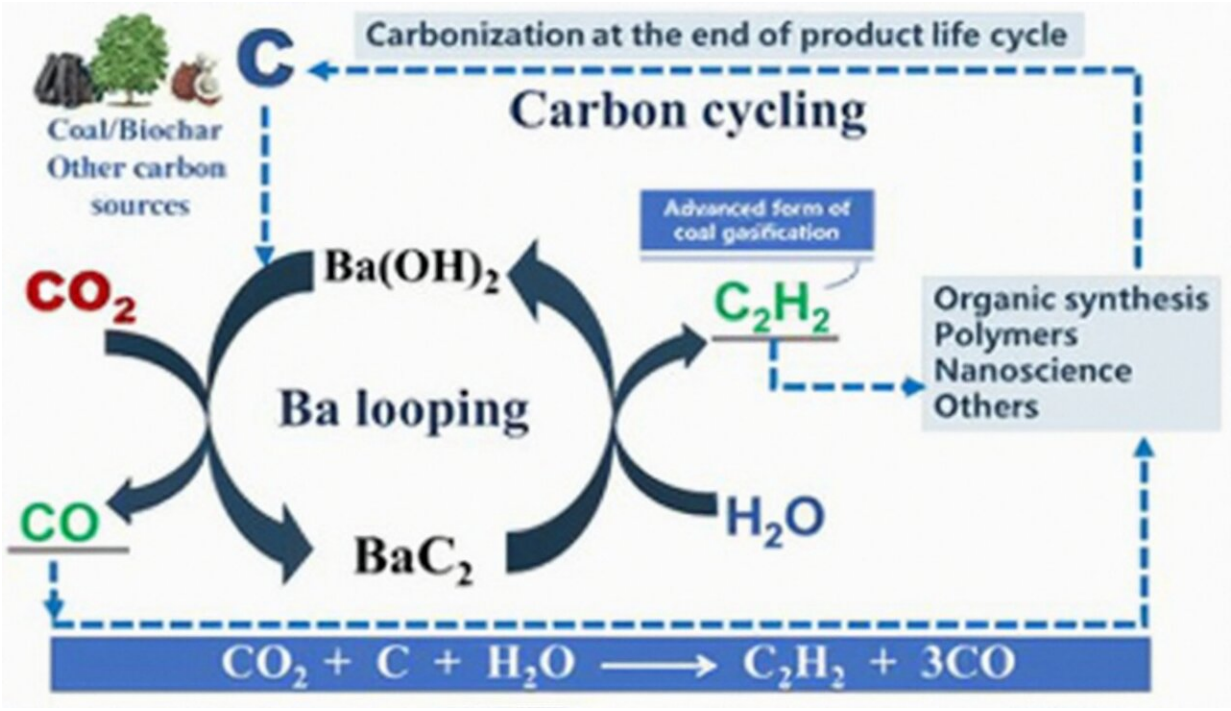
Novel sustainable coupling technology proposed for carbon-to-acetylene process

October 10 2023, by Li Yuan



Credit: *Green Chemistry* (2023). DOI: 10.1039/D3GC01775C

The carbide-based carbon-to-acetylene (C_2H_2) process is a simple pathway to convert various sources of carbon into acetylene and carbon monoxide directly. However, the current industrial process based on calcium carbide (CaC_2) is restricted by high energy consumption, significant amount of carbon dioxide and industrial solid waste emission.

Recently, a research team led by Prof. Zhao Hong and Prof. Jiang Biao from the Shanghai Advanced Research Institute of the Chinese Academy of Sciences has proposed a sustainable acetylene and carbon monoxide coproducing process based on $BaCO_3$-BaC_2-$Ba(OH)_2$-$BaCO_3$ barium cycle, which can simultaneously realize CO_2 capture and acetylene-carbon monoxide co-production at mild dynamic conditions with lower energy consumption and less waste emission.

The results were published in *Green Chemistry* on Aug. 16.

The researchers found that BaC_2 could be efficiently solid-phase synthesized at about 1,500°C by using carbon and $BaCO_3$ as raw materials without CO_2 emission, which is more than 600°C lower than the production temperature of CaC_2.

In addition, $Ba(OH)_2$ produced by the gasification of calcium carbide into acetylene was easily recovered and converted into $BaCO_3$ by absorbing CO_2, which was then used to synthesize carbide, verifying the coupling process between carbon-to-acetylene and carbon dioxide capture based on Ba loop, reducing the waste of carbide slag.

The results suggested that BaC_2 was the more suitable intermediate for carbon-to-acetylene process than CaC_2, because of the milder formation temperature, the faster reaction rate, and the more convenient barium recover to carbide production.

Featuring low cost, less wastes and high efficiency of co-producing of acetylene and carbon monoxide, this technology is expected to synthesize various of chemicals by using C_2H_2 and CO as platform chemicals instead of CO and H_2 produced by carbon gasification.

More information: Miao Li et al, Reengineering of the carbon-to-acetylene process featuring negative carbon emission, *Green Chemistry*

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