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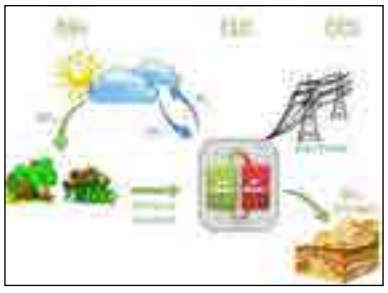
Bioenergy production through chemical looping processes

This work presents an overview of the recent advances in bio-CLC technology within the key strategies arising nowadays to mitigate climate change. The Paris Agreement, the new treaty of the United Nations Framework Convention on Climate Change (UNFCCC), urges to decarbonize the world energy systems in the near future in order to limit the increase in the average world temperature to 2ºC above pre-industrial levels. To reach this goal, CO_2 emissions should start to decrease by 2020 and become negative by the end of the century. Among the different options, most of the low-carbon scenarios rely on the use of BECCS (Bioenergy and Carbon Capture and Storage) as mandatory technologies to reach negative emissions. In this sense, Chemical Looping Combustion (CLC) is considered one of the most promising CCS technologies for power plants and industries because its inherent CO_2 capture avoids the energetic penalty present in other competing technologies. CLC process is based on the use of a solid oxygen carrier to transfer the oxygen from air to the fuel avoiding direct contact between them. The technology has undergone a great development during last 15 years including operational experience in continuous units and oxygen carrier's manufacture. In addition, the new Chemical Looping with Oxygen Uncoupling (CLOU) process represents a qualitative step forward in solid fuel combustion due to the use of materials with capability to release oxygen. There are several renewable energy sources that can be used in chemical looping processes, including both solid and liquid fuels. The use of biomass in CLC represents important advantages compared to conventional biomass combustion. Besides CO_2 negative balance, higher thermal efficiency, NOx formation reduction and lower corrosion in heat exchangers have been reported. In addition, several renewable liquid fuels, such as bioethanol can be also used both in combustion (CLC) and reforming (CLR) processes for heat/electricity and syngas/H_2 production, respectively. In summary, the use of renewable fuels in chemical looping processes represents at this moment a very promising opportunity for future green energy development.



Biography

Francisco García-Labiano is currently a Scientific Researcher at the Instituto de Carboquímica in Zaragoza, belonging to the Spanish National Research Council (CSIC). His research has been always close linked to environmental challenges in energy production processes. Since 2000, he has been involved in the development of the Chemical Looping Combustion (CLC), one of the most promising technologies within the area of CO_2 Capture and Storage (CCS) aiming to reduce global warming. More recently he has been actively engaged in the use of renewable fuels, such as biomass, bioethanol, etc. in Chemical Looping processes (bio-CLC) with the main objective to reach negative CO_2 emissions in energy processes. He is the author of more than 150 publications in international peer reviewed journals, 3 patents, etc. He has been recognized as Highly Cited Researcher by Thomson Reuters within engineering area in years 2015 and 2016.

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