**Develop Advanced Energy-related Materials to Reduce Carbon Footprint**

Cheng-Lung Chen

Institute of Physics, Academia Sinica

**Abstract**

Climate change has become an urgent issue, so the international community has set the goal of achieving zero carbon emissions by 2050.

The adoption of carbon tax is a coercive way to drive the cost-efficient transition to a low-carbon economy, but it may also threaten business competitiveness. To deal with these rapid changes we should be more active in developing green energy technologies to reduce carbon footprint and meet energy needs. Carbon reduction using advanced energy-related materials with high catalytic activity or high energy conversion efficiency has become a top priority. Two related researches on the green energy have been studied in my research works and are expected to provide effective solutions. First is the thermoelectric materials which has been worked for many years. The second is a newly started Alpha Decarbonization Project of the Academia Sinica this year. In my talk, I will first introduce my studies and achievements on several high ZT thermoelectric materials such as Bi2Te3, SnSe and GeTe, discuss the rational material design, and give an outlook of further opportunities in thermoelectric research.

In the second topic of my talk, I will introduce the Alpha Decarbonization Project of the Academia Sinica and discuss how to use molten metals-based catalytic pyrolysis technology to achieve effective decarbonization. The current experimental results prove that the CO2 emissions from industrial sector can be reduced by at least 10% in a relatively short period of time. As the technology matures, more CO2 emissions can be significantly reduced. To achieve the goal of commercial operation of this technology in our country as soon as possible, the rational design of catalytic pyrolysis, scale-up and system integration have been carried out and will also be discussed here.