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Green Catalytic Conversion of Biomass Platform Molecules to Useful Products

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Abstract

Over the past century our society has become heavily dependent on fossil fuel sources such as coal, gas and oil to produce our daily needed energy and chemicals. [1] The carbon dioxide produced by these non-renewable carbon sources has been significantly altering the climate on Earth and our heavy reliance makes them more expensive and less abundant. [1-3] Conversion of lignocellulosic biomass to renewable fuels and chemicals has attracted significant attention as a key technology to enable the replacement of petroleum. [4] Lignocellulosic biomass is the most promising renewable carbon energy source, as it is widely available around the world at a relatively low cost. It is composed of three main fractions: cellulose, hemicellulose, and lignin. [4] Although it is the most abundant plant material resource, its exploitation has been limited by its composite nature and rigid structure. In view of these facts, the conversion of biomass feedstocks into valuable products has been investigated, usually in multistep processes using platform molecules as intermediates. Bio-derived molecules, such as gamma-valerolactone (GVL) and 2,5-dimethylfuran (DMF), are important platform molecules that can be produced from biomass at good yields.[4] It has recently been demonstrated that these platform molecules can be converted into aromatics (particularly p-xylene) over acidic zeolite. [5] We have recently studied their catalytic conversions to useful fuels and chemicals over some of novel catalysts [6-11].

In this conference, we will report a number of new catalytic conversions of biomass-derived molecules to useful fuels and chemicals over some of novel catalysts. They may offer hints to develop key green catalytic technologies to enable the replacement of non-renewable sources for our fuels and chemicals in future. We will particularly demonstrate the uses of the start-of-the-art characterization techniques including synchrotron radiation, STEM and NMR to facilitate the mechanisms elucidation of these new catalysts.

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