Towards a zero-carbon footprint future – Linking fundamental science with practice

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The conversion of lignocellulose to fuels has seen significant attention in attempts to reduce the carbon footprint. These efforts also highlighted, however, how little is known about catalyzed transformations in condensed phase on a molecular level. In particular the source of the required H_2 and its integration into an overall process has not been addressed. As H_2 is required to be produced from renewable resources such as wind energy, the resulting conversion units will be much smaller than in today's practice. The small scale will require breakthroughs such as the integration of electrocatalysis and thermal catalysis as well as to lower the reaction temperatures and to simplify the conversion of a bioderived feedstock to fuels. The lecture explores, thus, fundamental aspects of liquid phase reductive conversions to produce fuels catalytically. Four key steps in the sequence are discussed in detail, the hydrolytic and hydrogenolytic deconstruction of lignin, the electrocatalytic hydrogen addition, the hydrodeoxygenation, and the hydroalkylation to build up larger molecules.