Direct synthesis of methyl formate from hydrogen and CO_2

Methyl formate is one of the most important C1 building blocks and forms the foundation of a complex downstream chemistry that enables the (partial) substitution of classical petrochemicals. In this context methyl formate can be understood as a chemical storage of hydrogen, CO and CO_2. Currently synthesis is carried out by carbonylation of methanol using sodium methanolate. This homogeneous catalyst, however, has a number of disadvantages. These include the formation of solid by-products that lead to clogging of pipelines and valves. In addition, very pure and dry raw materials must be used, which increases process costs. In addition, methanol conversion rates are very low at only 30%. A promising alternative is the direct synthesis of methyl formate from hydrogen and CO_2. In contrast to the process, this is a heterogeneously catalysed reaction, which allows the catalyst to be separation and regeneration of the catalyst, thus improving process economy. Furthermore, this approach allows the coupling of more diverse feedstock sources. CO_2 from e.g. flue gas, biogas or the air can be used. Potential hydrogen sources are reforming processes, fermentations and water electrolysis.