

# THE CATALYTIC CARBON DIOXIDE –FORMIC ACID CYCLE FOR HYDROGEN STORAGE AND DELIVERY

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The interconversion of hydrogen and carbon dioxide/carbonates to chemical energy carriers has attracted considerable interest for the development of novel energy technologies, because it combines hydrogen storage and CO<sub>2</sub> utilization. Carbon dioxide and carbonates have been proven to be viable H<sub>2</sub> vectors, as these widely available natural C1 sources can be easily hydrogenated to formic acid and formates. On the other hand, formic acid can be selectively decomposed into CO free carbon dioxide and hydrogen, H<sub>2</sub> gas can be generated very efficiently from formic acid in homogeneous catalytic reactions, using ruthenium and iron catalysts with phosphine ligands.

## Summary

Hydrogen is one of the potential candidates as energy vector to replace fossil fuels both for environmental and for economic reasons. H<sub>2</sub> has the advantage to form only water when it is burned; and combined with fuel cell technology a very efficient conversion of the chemical energy into electricity can be achieved.

However, the storage and delivery of H<sub>2</sub> remains a challenge: conventional hydrogen storage methods like high pressure gas containers and cryogenic liquid containers have weight and safety issues.

Hydrogen can be generated very efficiently from formic acid in homogeneous catalytic reactions, using ruthenium and iron catalysts with phosphine ligands.

On the other hand, the straightforward hydrogenation of CO<sub>2</sub> and carbonates leads to the production of formic acid/formate salts, making these system reversible and carbon dioxide neutral process.

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References

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