

# **Efficiency and conversion optimisation of tubular vortex flow stabilised microwave plasma reactors**

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A total efficiency measure for a reactor with some energy efficiency and conversion rate is determined for a given CO separation enthalpy from a CO<sub>2</sub>-CO-O<sub>2</sub> mixture. The efficiency and conversion losses are categorised in three components: slippage, heat loss and backreaction. Slippage reduces the conversion rate, heat loss reduces the energy efficiency and back reaction reduces both. The effect of each component on the total efficiency measure is analysed. The components are identified in the usual microwave reactor configuration with tubular vortex stabilisation. Previous measurements are interpreted in terms of these loss components. Slippage is estimated from composition measurements [1]. Heat loss is measured along the reactor tube and at the reactor exit by infrared imaging and thermocouple measurements. A method is devised and used to determine the backreaction experimentally along the tube axis in the afterglow. The relative importance of the various components to the total reactor efficiency is discussed and schemes to improve total efficiency are proposed.

[1] A. van de Steeg, PhD Thesis, Technical University Eindhoven. 'Insight into CO<sub>2</sub> Dissociation Kinetics in Microwave Plasma using Laser Scattering'