

Transition Metal Carbide Synthesis and Characterization for Use in Electrochemical Energy Conversion

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The Institute of Physical Chemistry at the University of Innsbruck comprises three groups working on *Chemical Energy Conversion at Surfaces*, *Materials- and Electrochemistry* and *Physics and Chemistry of Supercooled Water and Ice*. Two of these groups share a common focus in transition metal carbide (TMC) materials' use for electrochemical energy conversion, which is the topic that will be presented.

According to theoretical calculations,^[1] TMCs promise to show low overpotentials, high activities and high selectivities in the conversion of CO₂ to useful chemicals. The enhanced catalytic behavior of TMCs, unlike their parent transition metals, is related to their ability of breaking the binding energy scaling relations for the corresponding reaction intermediates.^[1] They can easily break C-O bonds and are thus reactive towards CO₂ reduction.^[2] For most TMCs, a comprehensive understanding of their electrocatalytic properties still needs to be elucidated. This study consists of the synthesis of different TMC films and powders and their characterization in terms of morphology, structure, interface chemistry and electrocatalytic performance. For *in situ* investigations of the CO₂ electroreduction, cyclic voltammetry has been combined with subtractively normalized interfacial Fourier transform infrared spectroscopy (SNIFTIRS) and with differential electrochemical mass spectrometry (DEMS) to detect adsorbed reaction intermediates at the electrode surface as well as gaseous reaction products under CO₂ reduction conditions.

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