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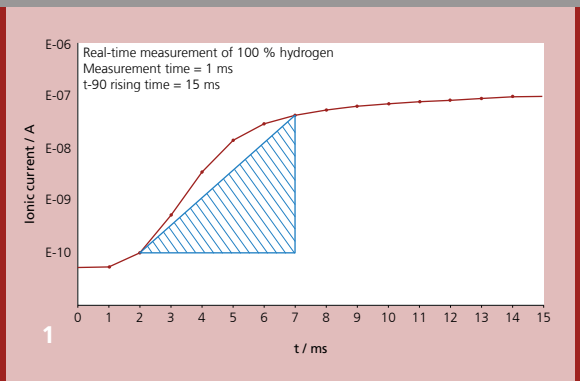
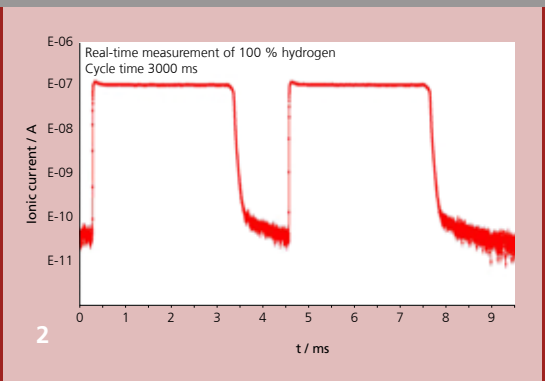
FRAUNHOFER INSTITUTE FOR CHEMICAL TECHNOLOGY ICT





1 *For a real-time measurement of 100 volume% of hydrogen, the t90 rising time is only 15 ms.*

2 *The temporal resolution is 1 ms, which means that the hydrogen can be measured with a sampling rate of 1000 Hz.*

3 *Online mass spectrometer.*

REAL-TIME MASS SPECTROMETER FOR HYDROGEN

A key requirement for safety tests and for the further development of hydrogen-powered vehicles is the online analysis of the hydrogen concentration. At the Fraunhofer ICT a measurement technique has been developed which enables the hydrogen concentration to be measured in the gas phase in real time, within a matter of milliseconds.

The measuring principle is based on mass spectrometry with electron impact ionization. The vacuum setup was specifically designed for the light gas hydrogen. Application areas for the real-time measurement of hydrogen are safety tests and the further development of internal combustion engines and fuel cell systems. The measuring method also allows mapping of the flow profile of hydrogen streams by real measurements. Until now this could generally only be carried out using simulations, with calculations derived from certain model assumptions. Last but not least, the measuring system can also be used for leak detection, and thus replace the leak detector, which is an essential tool for hydrogen-powered vehicles.

The real-time mass spectrometer covers the maximum possible concentration range of seven decades for the measurement of hydrogen. Concentrations of up to 100 volume% of hydrogen can be measured. Well-known for its high sensitivity, the mass spectrometer can also detect very small concentrations of hydrogen, down to 100 pb.The response time of the measuring system is 190 milliseconds. This is the time required to transport the hydrogen from the place where it is extracted in the vacuum to the ionization chamber in the mass spectrometer.

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