Measurement of hydrogen release from metal hydrides using an on-line mass spectrometer

IPI InProcess Instruments
Gesellschaft für Prozessanalytik mbH

The usage of hydrogen in energy technologies has great potential. Unlike fossil fuels it can be generated from renewable energy sources. It is also non-polluting, and forms water as a harmless oxidation product during use. The storage of hydrogen still remains a problem, so that its use as a fuel has been limited.
One of the favoured solutions to this problem is storage of hydrogen in hydride form. Metals or alloys can absorb and hold large amounts of hydrogen by forming hydrides as reactants. Thus they absorb the isotopes of hydrogen in different ways.

Research is being conducted to modify the composition and synthesis of these materials. The desorption process has always been a major field of interest in carrying out investigations on metal hydrides.

The simple experiment shown here is a convenient way to investigate release of hydrogen and their isotopes from metal hydrides: The metal hydride sample (approx. 1 g) was placed in a crucible within the inner quartz tube of a tube furnace. A continuous flow of argon was conducted through the quartz tube. During the temperature controlled heating process the concentration of hydrogen (and their isotopes) in the argon stream can be measured with the GAM200 on-line mass spectrometer.

The diagram shows the result of the thermal release of deuterium from a lithium deuteride sample. The main desorption process starts at 620°C. But in an earlier desorption step starting at approx. 400°C the impurities H_2 and HD together with some D_2 are released. This leads to the assumption that for the hydrogen isotopes in the lithium deuteride different types of binding characteristics occur.

The advantage of using the mass spectrometer for this experiment is the isotope specific detection at masses 2, 3 and 4 for the different hydrogen species. Thus the on-line GAM200 mass spectrometer is faster and more sensitive compared to other hydrogen detection methods.