

General Aspects of the Density Measurement with an Oscillating U-tube Density Meter under High Temperatures and High Pressures

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Density measurement based on the oscillating U-tube principle was invented by Hans Stabinger over 40 years ago. Since then the density measurement and the determination of concentration of liquids and gases was revolutionized by this technique. The main advantages compared to other methods (e.g. pycnometer, hydrometer) are excellent accuracy, short measurement time and small sample volume. Density meters are used in many different industries and applications such as food, chemical, petroleum etc. Typically density measurements are performed at ambient pressure and moderate temperatures, i.e. up to 95 °C with density meters having an oscillating glass U-tube. In order to study samples at elevated pressures and temperatures, a special design of the density meter is required. Furthermore, the material of the U-tube has to withstand the extreme conditions. Hastelloy C-276 has proven to be the material of choice for this application due to its excellent high-temperature and high-pressure stability and chemical resistance against corrosive media. The DMA HPM density meter is the only commercially available instrument using the oscillating U-tube principle for density measurements at temperatures up to 200 °C and pressures up to 1400 bar. In the presentation the basic principle of the oscillating U-tube is discussed. The importance of measuring density at high-pressure and high-temperature is demonstrated on the basis of practical application examples. In addition it will be shown which parameters are influencing the accuracy of the density measurement.