

Advanced Calibration, Adjustment, and Operation of a Density and Sound Speed Analyzer

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After years of decline, thermophysical property measurements are experiencing a renaissance that can be attributed to several factors. First, as the limitations of simulations become apparent, there is a renewed appreciation of the need for reliable experimental data. Second, measurements have become increasingly feasible with improvements in instrument technology. For example, the development of miniaturized sensors and detectors that can be fitted into benchtop measurement systems allows for shorter thermal equilibration times and higher throughput. Furthermore, the use of dry thermoelectric thermostating systems makes automation of measurements possible for unattended operation. Such benchtop instruments for measurements at atmospheric pressure can yield valuable data of near standard reference quality if they are calibrated, adjusted, and operated in an informed manner. To illustrate this point, long-term experiences with a benchtop density and sound speed analyzer will be discussed in this contribution. Examples of failures and successes will be shown for measurements of water, toluene, cyclohexanes, fuels, and biofuels. Issues that will be discussed include sample purity, the importance of reproducibility over repeatability, and the need for expanded calibration and adjustment protocols.