Peltier Heat/Cool System for Materials Analysis

- Turn key temperature control system
- Extensible with Novocontrol Dielectric/Impedance Analyzers
- Designed for easy, safe and fully automatic operation
- wide temperature range: –50°C to +200°C
- 0.1°C stability
- Includes PHECOS PID controller with non-linear extensions, stabilized power supplies, dual-stage Peltier element
- Optional sample cell set-ups for standard dielectric samples, interdigitated sensors, electrochemical and ionic conductivity measurements

PHECOS

novocontrol Technologies

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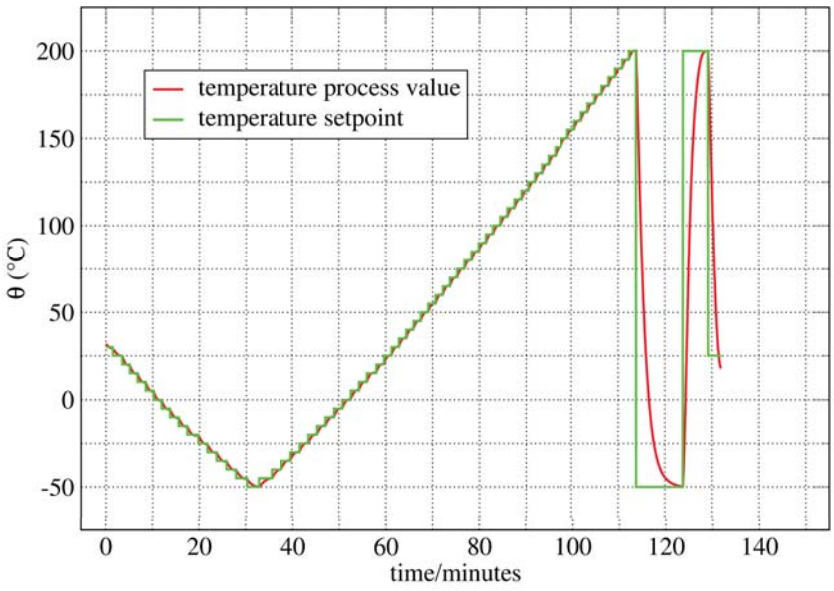
Temperature Control Applications

Today, most materials and devices are required to operate without failure in a certain temperature range. The so-called industrial range, e.g., is usually considered to extend from –40 °C to +85 °C, the automotive range from –40 °C to +125 °C. Broadband Dielectric and Impedance Spectroscopy is a perfect technique for the electrical characterisation of materials and technical samples like, e.g, membranes, sensors, batteries, and solar cells. Since many sample properties drastically change upon temperature variations, such measurements require a stable, reliable, and easy-to-use temperature control system. In addition, it is desirable to have the option of performing fully automatic measurements of the electrical properties (like, e.g., complex permittivity, conductivity, and impedance) as a function of temperature in the frequency and time domains.
The relevance of a highly stable and reliable temperature control system is frequently underestimated. Researchers and engineers may waste tremendous amounts of time when applying inadequte means of temperature control, especially if simple ways of automation are not in reach.
PHECOS is a high quality turnkey temperature control system for applications in materials research, dielectric testing, and electrochemistry. Variaous sample cell setup, e.g., for standard dielectrics, interdigitated electrodes, and electrochemical measurements are available as options. The system has been developed to set or change the temperature of the sample under test with high accuracy and reproducibility. PHECOS is modular and may be combined with any Novocontrol dielectric or impedance analyzer (connection via BNC cables).
Since PHECOS is based on a dual-stage Peltier element whose sole resource is electrical power, no cryogenic fluids are required for the temperature control operation.
The new PHECOS Heat/Cool System provides easy, safe and fully automatic operation, enabling computer-controlled long time experiments over several days without supervision.



Stabilization characteristics of the sample temperature (process value) compared to the temperature set point (step function). Set point step after sample temperature stabilization.

PHECOS Features

- High-quality temperature control system for dielectric and electrochemical impedance measurements
- Modular setup with several sample cell set-ups for e.g. dielectric and impedance material measurements, 2, 3 or 4 wire configurations for electrochemical samples and interdigit electrodes for e.g. monitoring of chemical reactions and curing of epoxies or glues or paints.
- Supports external gas inlets and outlets for defined atmosphere within the sample cell volume.
- Compatible with Novocontrol Dielectric / Impedance analyzers, potentiostats / galvanostats and high voltage interfaces.
- Compatible with Novocontrol WinDETA and WinCHEM software for electrical characterization of materials and technical samples in the frequency and time domains.
- Operating principle: Dual-stage Peltier heat/cool system
- T range: –50 °C to 200 °C ($T_{ambient}$ < 25 °C)
- T stability: 0.1 °C
- T accuracy: 0.2 °C
- temperature ramps from 0.01 °C/min up to 30 °C/min
- temperature overshooting after set point step typically < 1 °C
- stabilization times typically below 5 minutes (for 0.1 °C stability)
- microprocessor controller with 24 bit ADC and IEC communication port