

- Measurement of gelling and curing under reduced and constant temperature conditions.
- Continuous measurement of the relative permittivity of PU-CASE formulations using variable electric frequencies during the reaction.



Fig. 1: The SubCASE® LT is designed to measure the gelling and curing reaction at low and constant temperatures. The relative permittivity of a formulation is measured simultaneously at different electric frequencies.

Advanced Measurement of Gelling and Curing

For testing the reaction profile of PU-CASE (Coatings, Adhesives, Sealants and Elastomers) formulations, the measurement of the relative permittivity during the transition from the liquid mixture to the finished cured material is a well-established laboratory method. The relative permittivity is commonly known as the dielectric constant. During the chemical reaction from liquid to solid the amount of polyol- and isocyanate groups is decreasing, usually causing a decrease of the relative permittivity.

The relative permittivity of the reactive material depends on the frequency of the applied electric field and the test temperature. Format Messtechnik GmbH has introduced a new technology of the Pot Life and Curing Monitor SubCASE®: It continuously varies the electric frequency while measuring the relative permittivity of the formulation during the reaction process (Figs. 2, 4). Due to scanning the relative permittivity at different frequencies, a better correlation between the relative permittivity and the viscosity can be established. Even intermediates e.g. amines, generated by the water - isocyanate reaction, can be seen at certain frequencies, thus revealing information

about the chemical reaction process.

Additionally a new low temperature model named SubCASE® LT (Fig. 1) has been developed. It is connected to a refrigerated bath circulator, in order to keep its base plate at a reduced temperature (Fig. 5). SubCASE® LT is especially designed to measure the gelling and curing under reduced and constant temperatures, e.g. for simulating outside winter conditions (Fig. 3). The advantage of SubCASE® LT is, that it can dissipate the heat, generated by the exothermal reaction, from the test sample. This feature can be used to simulate the reaction behavior of a formulation on surfaces with high heat capacity, e.g. for coating applications .

The new scan mode of the relative permittivity gives a better and deeper insight into the chemical reaction process of Coatings, Adhesives, Sealants and Elastomers. Due to the new low temperature model SubCASE® LT, tests under reduced and constant temperatures can be performed. The new advanced measurement technology can be used in research, development, as well as in quality control measurements of PU CASE formulations.

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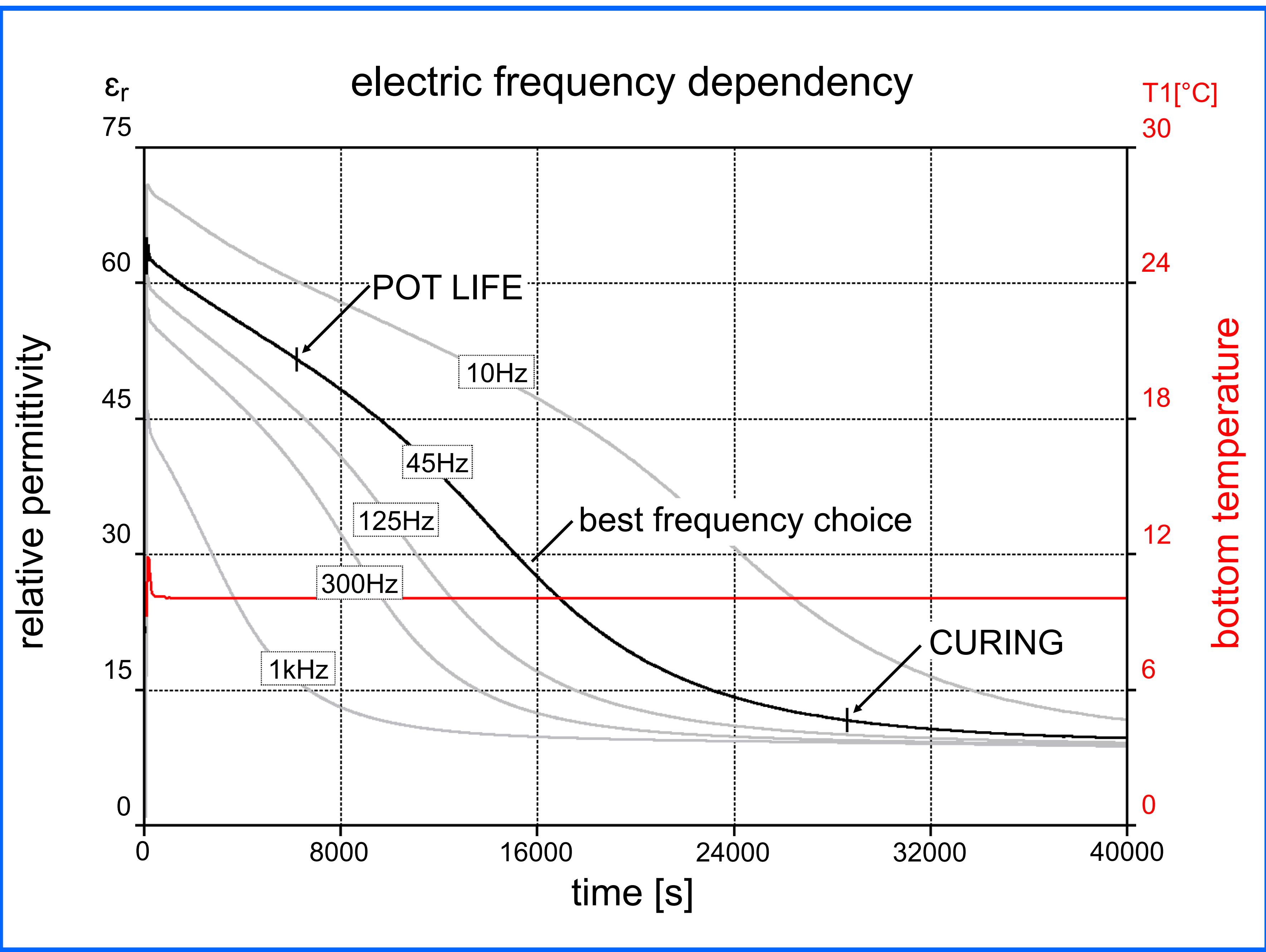


Fig. 2: SubCASE® LT measurement of a PU coating formulation using variable electric frequencies. The relative permittivity measured at 45Hz correlates best with manually detected results.

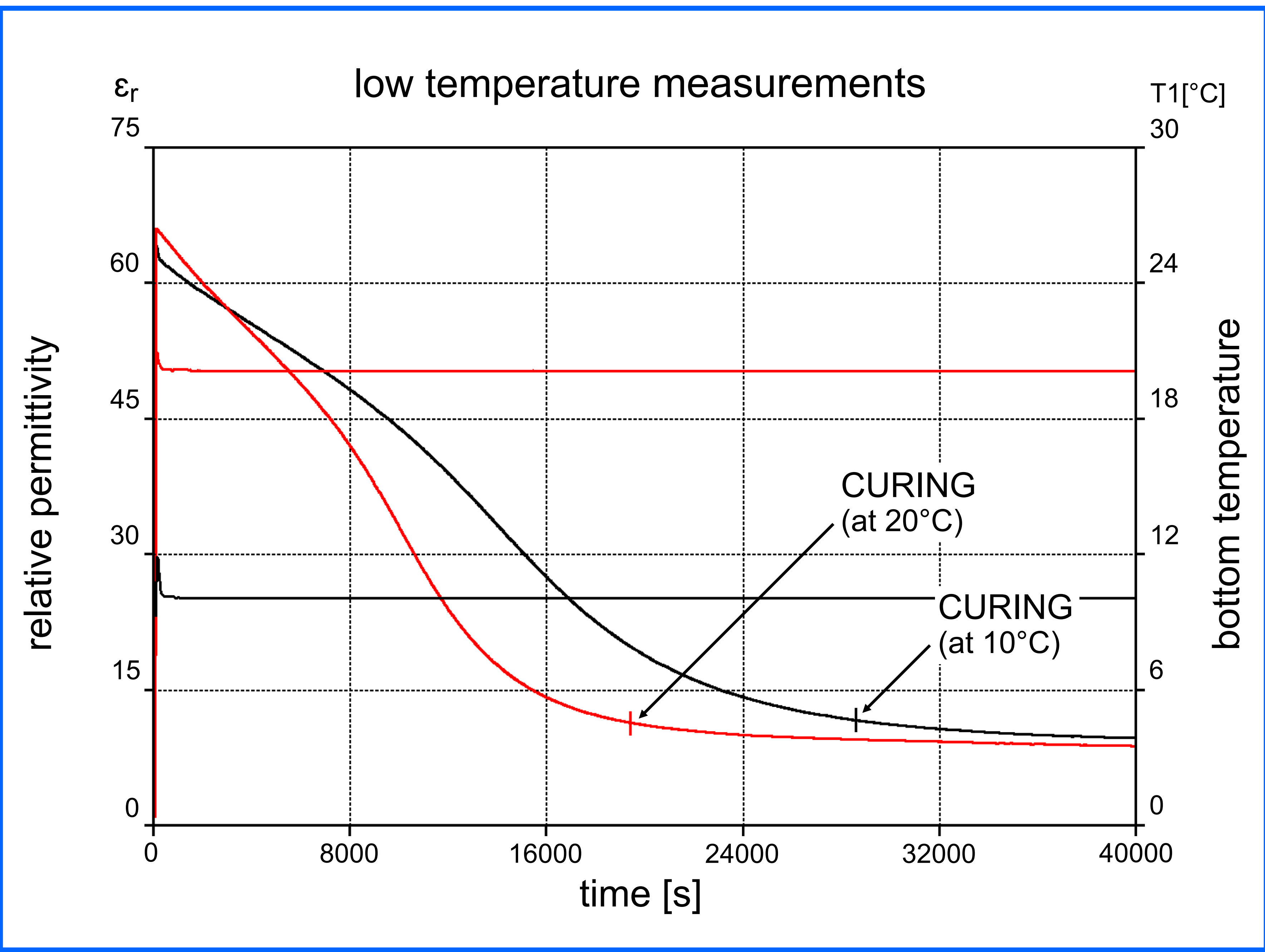


Fig. 3: Comparison of two SubCASE® LT measurements at different low temperatures. A PU coating formulation was tested at 10°C and 20°C. The change in the curing behaviour can be seen quite well.

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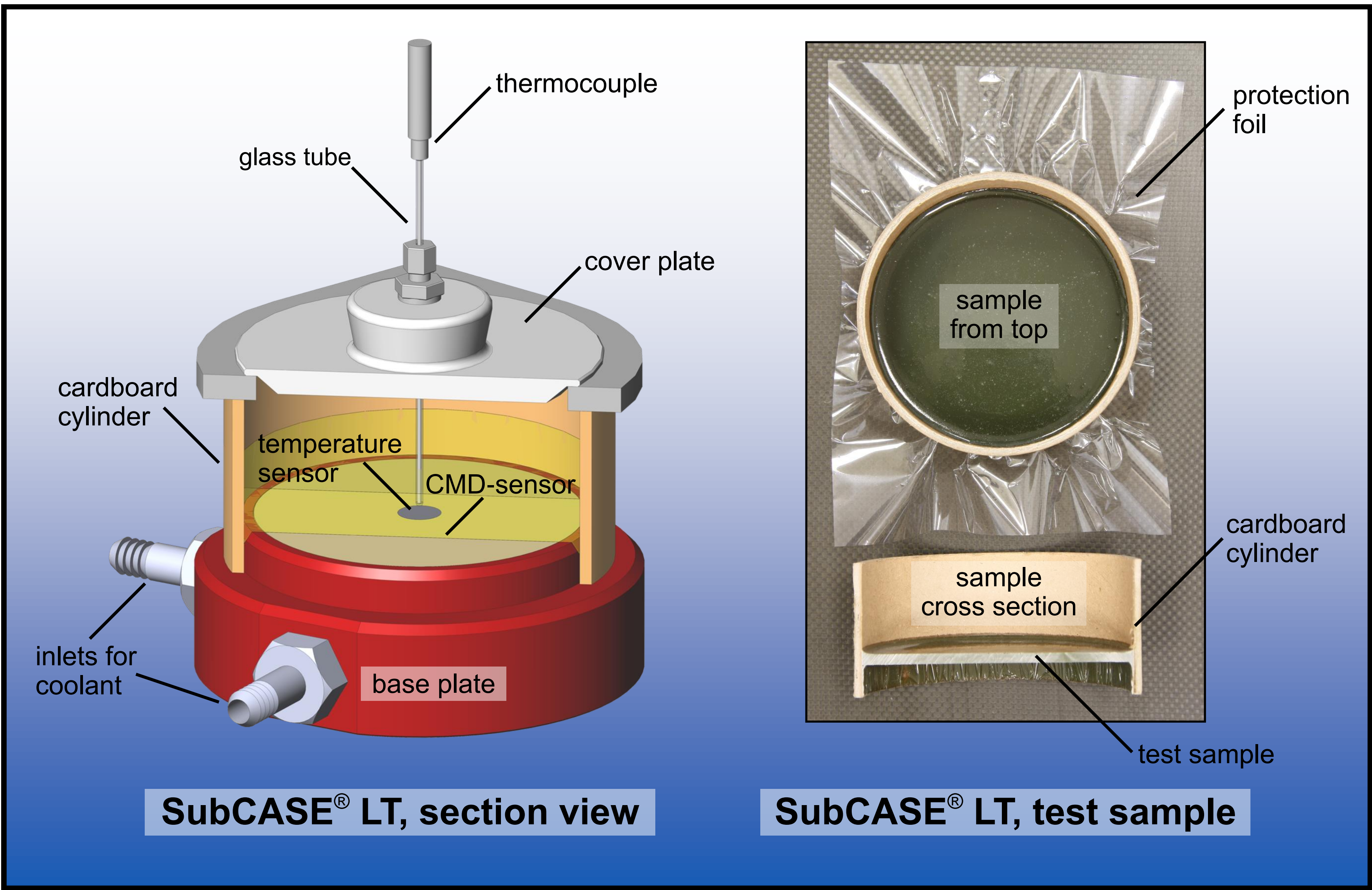


Fig. 5: Section view of SubCASE® LT and its test container. A refrigerated bath circulator is connected for temperature control. A thin test sample is cast into a disposable cardboard cylinder (right). The CMD-sensor measuring the relative permittivity is covered by a protection foil.

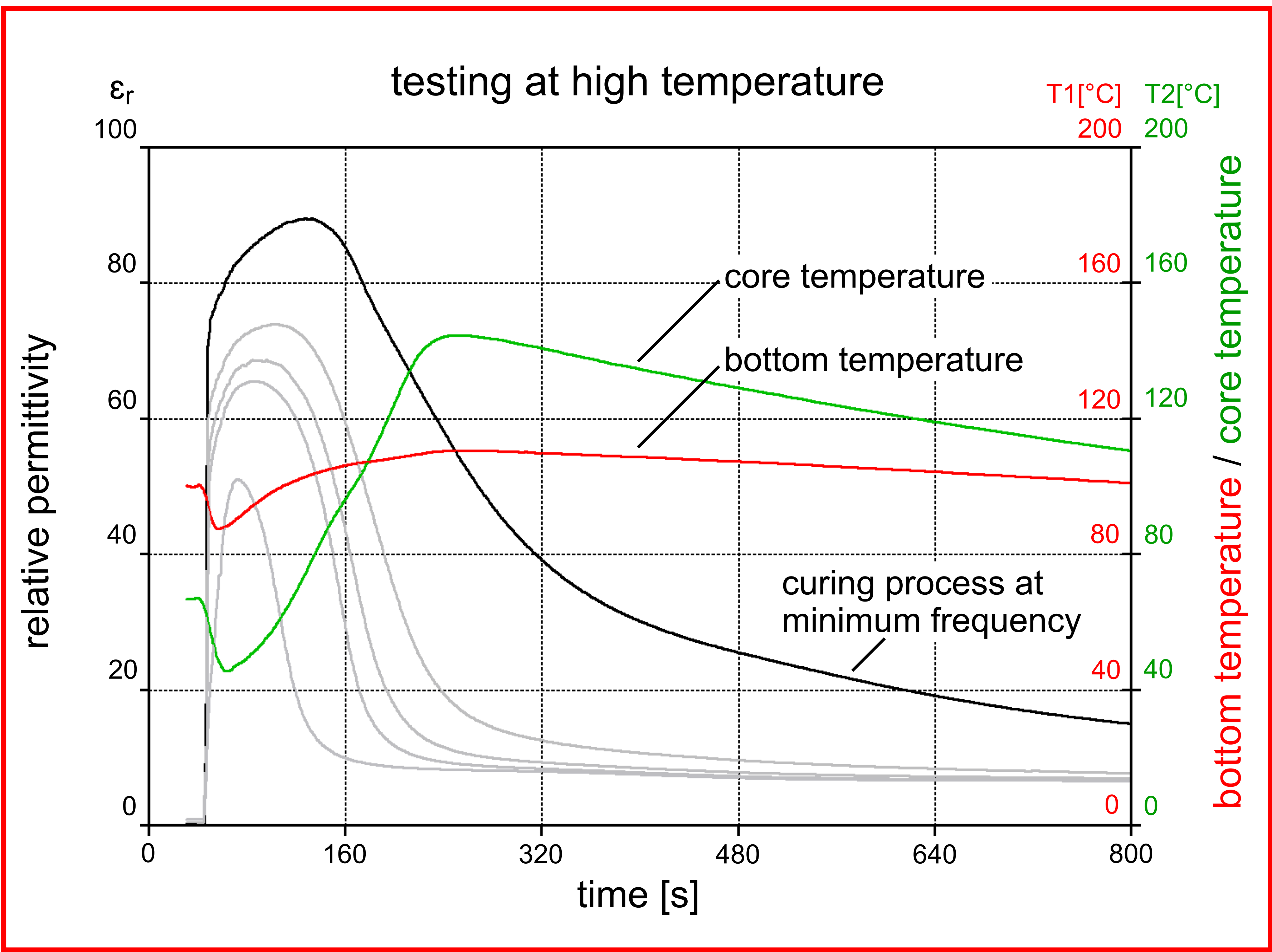


Fig. 4: Test results of a PU casting formulation, measured at high temperature with SubCASE® HT. Even long term chemical reactions can be seen by applying minimum electric frequency.