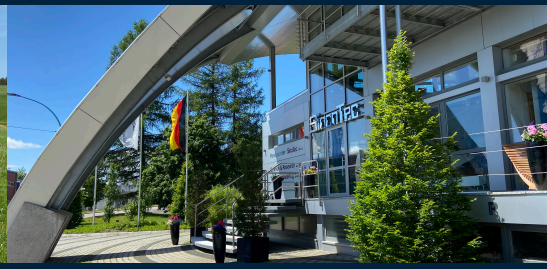
SincoTec NEWS

New POWER SWELLING test system
Simulation of longitudinal strain of battery cells in cases due to charging and discharging processes

We test the future
Safe offshore hydrogen generation, storage and transportation

Our POWER FRAME
Loadframe facelift of the force-excited universal test system



SincoTec Group Edition 2023 Issue 01

Dear SincoTec friends,
Dear SincoTec customers,

dynamic economic and turbulent political events are accompanying us these days. Many are wondering what the future will hold. In these times, constancy, trust and continuity are particularly important values that matter in business. For 32 years, we have been on the road for you as a medium-sized family business, offering testing products and services of a special kind. We already accompany some of you to the remotest corners of other continents and ensure the high quality and safety of your products worldwide.

Every day we do our utmost to provide you with the best, fastest, most energy-efficient, and most reliable test technology.

The coming decade will be characterized by new drives, extreme light weight construction, consistent energy efficiency and intelligent, complex test technology. In all these areas, we have developed solutions to meet your challenges.

We are happy to meet your requirements and develop, manufacture and assemble for you in a technology- and customer-oriented manner, 100% "Made in Germany".

We look forward to supporting you reliably in the future and to being successful together.

Together we make the world safer!

On behalf of the SincoTec-Team

Dr.-Ing. Joachim Hug,
Sabrina Hug-Lohmüller, M. Sc.
Dipl.-Ing. (FH) Sven Henze,
Dipl.-Ing. Steffen Krause and
Dr.-Ing. Marcel Heß

Dr.-Ing. Marcel Heß appointed as authorized representative of SincoTec Test Systems GmbH

Since 2021, Dr.-Ing. Marcel Heß has been the technical manager of SincoTec Test Systems GmbH and has now been appointed authorized representative.
Mr. Heß is thus responsible for the operational business of the testing machine manufacturer of SincoTec Test Systems GmbH together with the managing partner Sven Henze.
Mr. Heß completed his mechanical engineering studies at the Clausthal University of Technology and earned his doctorate at the Institute of Mechanical Engineering under Prof. Dr.-Ing. Armin Lohrengel. After receiving his doctorate in April2018,he joined SincoTecTestSystems GmbH. In his private life, Mr. Heß enjoys spending time with his family and volunteers with the German Federal Agency for Technical Relief.

Did you know, that ...

... the 50th DVM meeting will take place next year from 9-10 October 2024 in Clausthal? Look forward to the anniversary event under the title "Fatigue strength - no longer relvant? ... or the key to a safe, sustainable future!" with many interesting speeches.

Our POWER FRAME

Facelift for our load frames of the force-excited universal test systems

Streamlined, more functional, simpler:

The new **POWER FRAME** load frame provides a universal basis for any forcibly excited test.
The spectrum of excited universal, component and material tests is wide: In addition to servo-hydraulic, servo-pneumatic or servo-electric drives, a variety of different fixtures are available to realize universal as well as customer-specific dynamic testing solutions.

As a basis for these tests, SincoTec has given the load frame **POWER FRAME** with a facelift and incorporated the experience and advantages of other dynamic testing systems. This has resulted in a modular load frame for load ranges up to ±400 kN axial force.

In addition to the compact table with hole pattern for mounting individual fixtures or additional attachments, the setup features an electric column adjustment that can be moved over the entire specimen chamber height at the push of a button. Furthermore, the specimen chamber height can be customized and easily adjusted via a spindle and column extension - even retrospectively. Columns and spindles that can be separated from the stage simplify transport and insertion into difficult-to-access spaces.

The load frame concept is standardized to the nominal axial forces 30 kN, 100 kN, 250 kN and 400 kN. Hydraulic actuators are available for all sizes, each of which is bolted to the load frame table. The 30 kN load frame also offers the option of connecting the **AIR ACT** and **DRIVE ACT** standard actuators via an adapted crosshead. These can be mounted on the crosshead without any conversion effort - this enables flexible use of the actuators - for example, on the load frame today and on a clamping field tomorrow.

A suitable oil pan with level monitoring is available for applications with hydraulic actuators. An optional protective housing and a variety of suitable clamping devices from SincoTec round off the **POWER FRAME** in its universality and flexibility.

The load frames POWER FRAME in different sizes and drive units

We test the future:
Safe offshore hydrogen generation, storage and transportation

In a fatigue test, a crack is considered a failure of the specimen. We reported on such tests in the last News 2022-2. If one wishes to obtain more information about the service life of a component after a beginning crack, further tests must be carried out. Let us consider the following scenario:

By means of an offshore wind turbine, hydrogen is produced directly on the high seas from seawater by electrolysis. This hydrogen must be transported on land. Among other things, subsea pipelines can be used for this purpose. If you imagine a pipeline of this kind, it is obvious that even its inspection, and especially its repair, are extremely costly, since some of them have to be operated at great depths. These pipelines are exposed to various stresses, such as swell, high pressure, salt water, temperature fluctuations and, last but not least, the medium to be transported, in this case hydrogen.

Hydrogen, as the smallest known atom or molecule, has the property that it can diffuse into solid matter. In metals, this leads to a disruption of the lattice structure of the atoms, which can lead to embrittlement of the material. This is why the term "hydrogen embrittlement" is used.

If you now discover damage, e.g. a small crack in a pipeline, it is extremely important to know what the next steps should be: Is the damage still uncritical or must the pipeline be shut down immediately.

In order to make such an estimation of the state of the crack, one applies the methods of fracture mechanics.

Three areas are distinguished in the growth behavior of a crack:

I. The first range describes the recurrent stress at which the crack is not yet growing or is just starting to grow. This value is called the transition value (K_{th}).

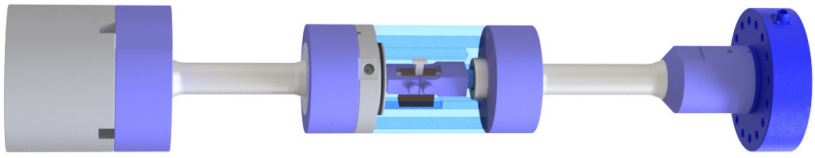
II. The second area describes the stress that leads to stable crack growth. With each oscillation cycle, the crack continues to grow. This area is described, for example, via the Paris law.

III. The third range describes the stress (K_{IC}) that leads to critical crack growth. In this range, the component fails almost immediately.

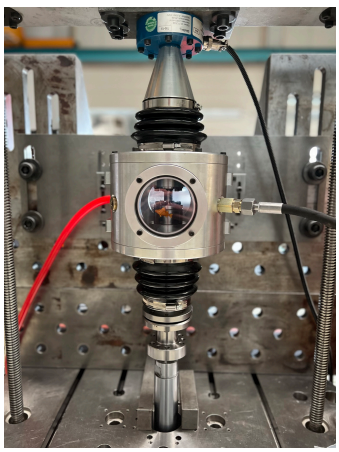
If the component is within the first two ranges, a remaining service life can be estimated with known stress and material properties, and repair measures can be coordinated accordingly.

If materials are exposed to hydrogen, the fracture mechanical behavior can deteriorate significantly. The above-mentioned material properties under the influence of hydrogen must therefore be determined and taken into account. Since gaseous hydrogen is usually also under pressure, the tests must be carried out in a special autoclave (up to 1,000 bar). SincoTec's patent-pending seal-free test equipment is ideally suited for this purpose, as dynamic loads can be applied to a specimen here in a hydrogen atmosphere and crack growth can be measured.

In this way, all three areas of crack growth can be investigated and the material characteristics can be determined. These characteristic values can then be used to make estimates of the condition of the crack and thus also of the component.



SincoTec high pressure test cell with CT sample

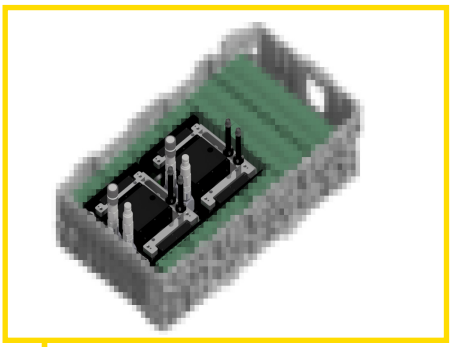


Test cell for testing in hydrogen at atmospheric pressure

Our newly developed POWER SWELLING test system

Simulation of longitudinal strain of battery cells in cases due to charging and discharging processes

Lithium batteries have the property of expanding during charging and contracting again during discharging, which introduces additional internal forces or loads into the housing of traction batteries. This behavior, also known as "SWELLING", has a potentially damaging effect on the battery housing and can significantly influence the service life.
With the SincoTec **POWER SWELLING** test bench, this behavior can be reliably mapped or the swelling loads simulated in order to test the mechanical strength of battery housings.
For this purpose, individual battery cells are removed from the housing and replaced by hydraulic actuators. The compact design and the integrated force and displacement measurement technology of the **POWER SWELLING ACTs** enable testing under conditions that are as close to reality as possible without changing the battery structure in a way that affects strength. For example, the cases can also be closed with their lids during the test. Due to the use of compact electronic connectors and hydraulic quick couplings, the necessary openings of the battery lid are not unnecessarily large. In order to be able to efficiently test even large battery structures for fully electric vehicles, the POWER SWELLING test machine can be operated with up to seven hydraulic actuators. These are controlled by a common hydraulic valve, which regulates the total force formed at the actuators. The control itself is performed by the proven SincoTec **TestPilot** controller and the **CoPilot** software. Damage detection is carried out, among other things, by adjustable travel limits.



Battery without cover

Exemplary setup of the test system with rolling worktable, here for testing a hybrid vehicle battery with six actuators

Did you know, that ...

… we are gradually converting our vehicle fleet to hybrid and electric vehicles and we also offer the appropriate test rigs for those?

Hot-cold and constantly under pressure

New development: flow-through internal pressure pulsation test rig

One not immediately visible but nevertheless relevant stress for vehicles with electric drives is the temperature of the individual components of the powertrain. Winter temperatures of -20°C can reduce the range of an e-vehicle by approx. 50%. Consistent monitoring and adjustment of the temperatures of the individual components in the e-drive can significantly improve performance, range and service life. An example of this is the battery. This is cooled in summer and during charging, but must be heated in winter. Thanks to the high efficiency of electric drives, they themselves produce relatively little waste heat. Additional components such as electric auxiliary heaters and heat pumps must therefore be used for heating. In addition, there is a large number of electrically controlled valves, evaporators, fans etc. It is therefore no longer appropriate to speak of a "pure cooling system" for an e-drive vehicle, but rather of a "thermal management system". Within this system, there are a large number of components that are subjected to two different temperatures at the same time. On the one hand with the temperature of the coolant, on the other hand with the ambient temperature in which the component is located. Added to this are pressure fluctuations in the cooling system. In order to be able to better simulate this load situation for testing the components, SincoTec Test & Engineering developed a flow-through internal pressure pulsation test rig.
On this test rig, the above-mentioned components, but also other components, can be flowed through with a temperature-controlled coolant and simultaneously subjected to pressure pulsation while these components are at an ambient temperature that differs from the coolant temperature. Ambient temperatures between -40°C and 140°C, media temperatures up to 120°C, pressures between 0 bar and 5 bar (relative) and volume flows up to 50 l/min can be generated.

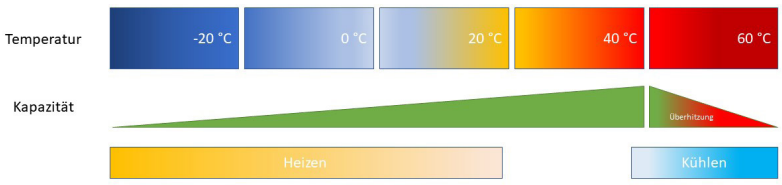
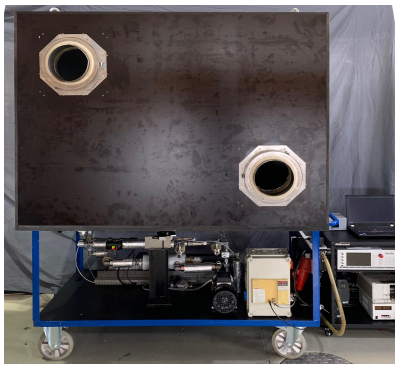


Diagram: Performance of a battery related to temperature



Internal pressure pulsation test rig

Starting the workday with YOGA

As part of our company health management, we offered a yoga course for our employees over a period of 10 weeks in cooperation with the Techniker Krankenkasse health insurance. Already at 7:00 am the participants started with the "sun salutation" and learned many dynamic as well as relaxing exercises.
Through the expert guidance of the yoga trainer, even the shoulder stand succeeded after a short time. Motivated by the early morning exercise, the workday could begin after 1 hour.

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