Strain measurement using Resistive Strain Gauges

Resistive strain gauges (RSG) are a wide-spread means to measure local surface strains, to analyse principal and residual stresses or to build force transducers. They are applied with various gauge lengths, geometries, and thermal compensation for many materials (Fig. 1).

Our laboratory has decades of experience in RSG application and measurement, equally well in combination with other measurands. We have available a decent number of measuring channels, both for static and dynamic measurements.

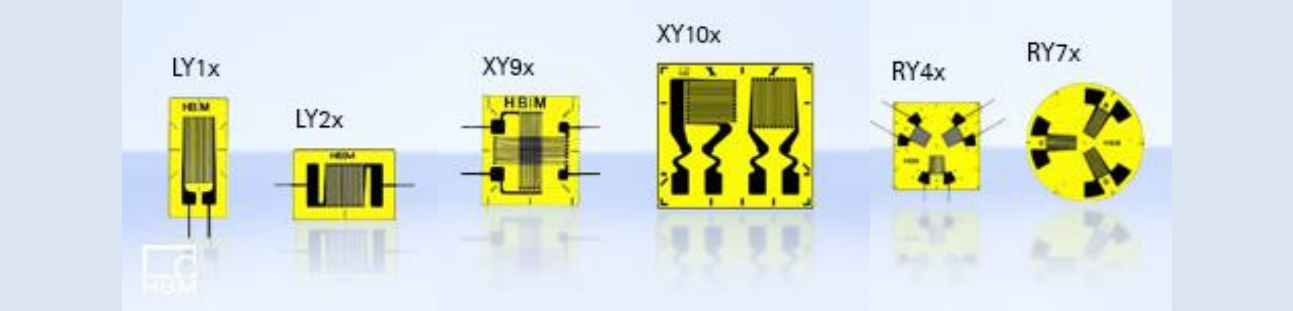


Fig.1: A selection of linear RSG, x/y RSG, and rosette RSG (HBM company).

Technical data:

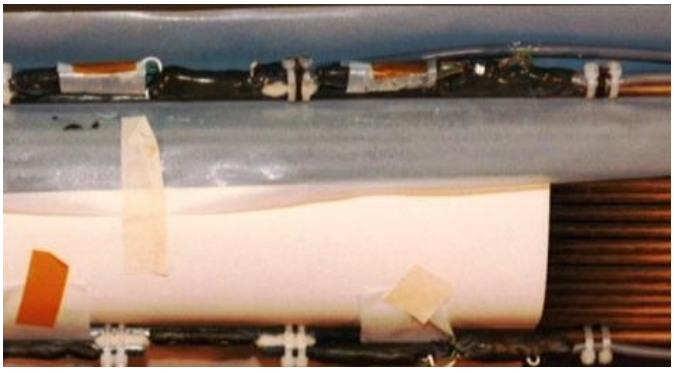
Maximum strain values	± 100'000	µm/m
Best uncertainty	2	µm/m + 0.01 ε
Types		linear, x/y, 0°/45°/90° rosette, 120° rosette
Gauge lengths	0.3 – 150	mm

Fig.2: Testing an RSG wiring on a stay cable made of carbon reinforced polymer (CFRP).

Some of our RSG applications

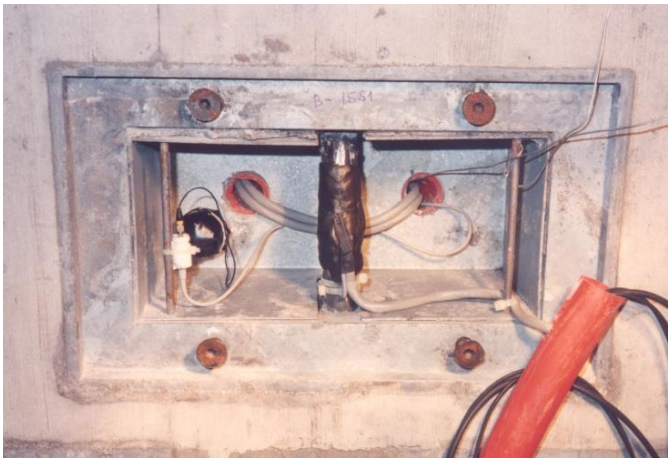
Civil engineering

Bridge construction: RSG applied on the anchor head of a pre-stressed cable. Emmen, Switzerland.



Bridge construction: RSG applied on CFRP wires of a stay cable. Winterthur, Switzerland.

Power dam: Concrete-casting of an RSG sensor during the heightening of the dam in Luzzone, Switzerland.



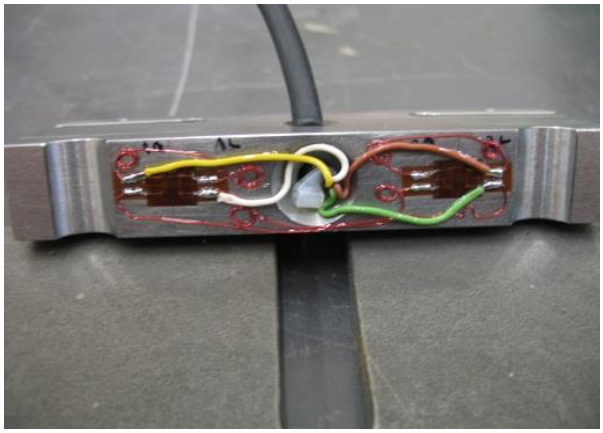
Fortification: RSG applied on armoring iron and protected against humidity. Thun, Switzerland.

Aerospace and rope way

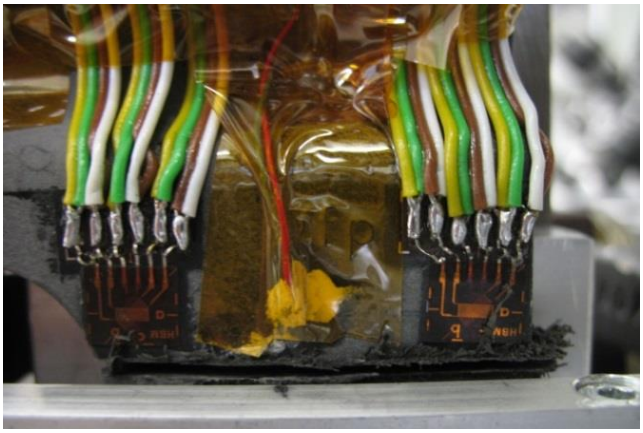
Ariane 5: Payload fairing during tension and pressure testing at Empa.

Teleferic cabin: RSGs applied to the traveling and suspension gear, and cabin (160 persons). Mayrhof im Zillertal, Austria.

Traffic engineering



Railway: 50 kN force transducer built for testing a tram bogie.

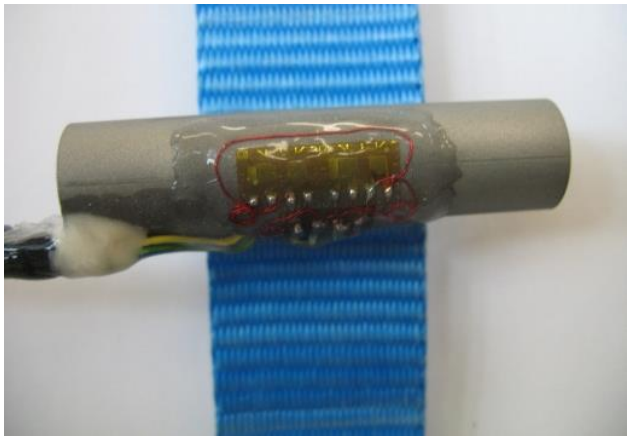


Railway: Analysis of residual stresses using the slit method, applied to die-cast railclamps made of glass fibre reinforced polymers.

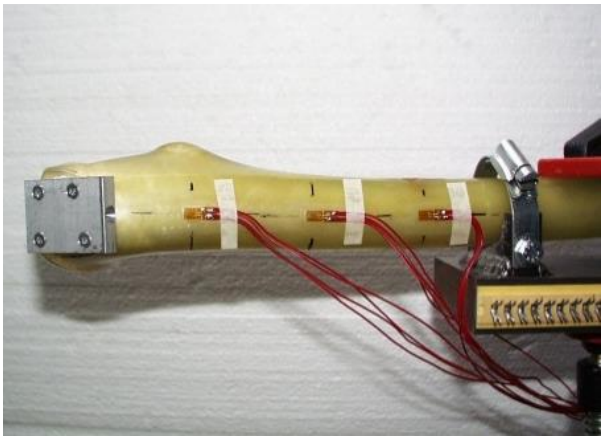
Road construction: Drill core sample equipped with 100 mm RSG for measuring hoop strains in compression.

Road construction: Application of RSG onto geo-textiles before integration to the roadway.

Medical engineering

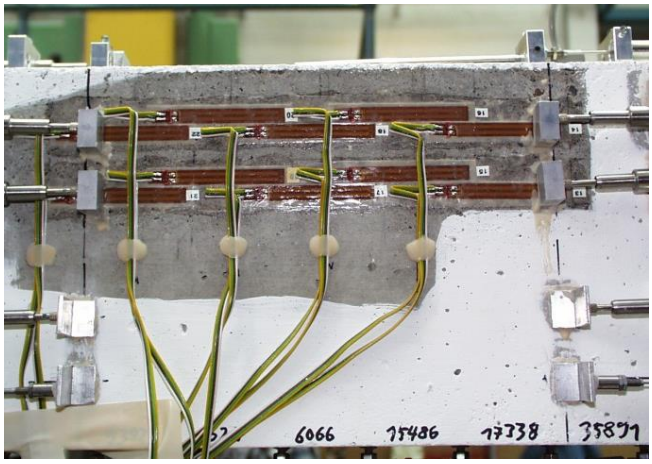


Sensor for measuring tensile forces on the shoulder straps of a back pack.

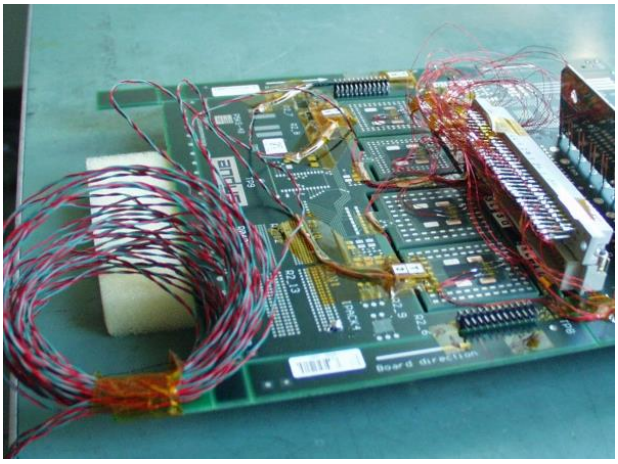


Glass fibre reinforced bone model equipped with RSG for the development of a hip prosthesis.

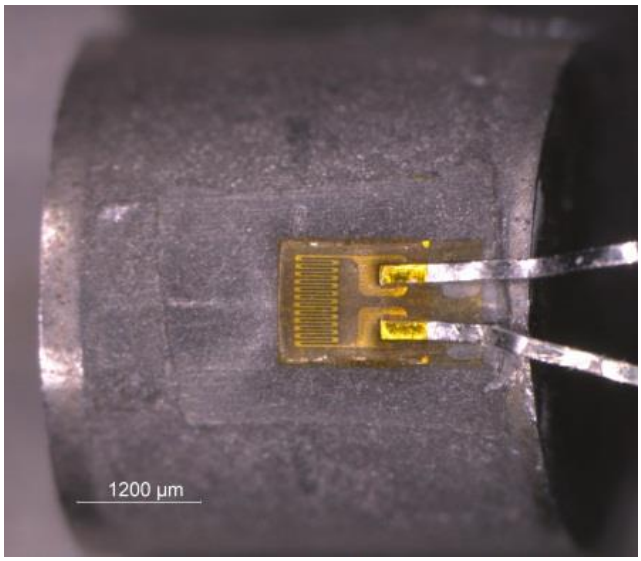
Material science



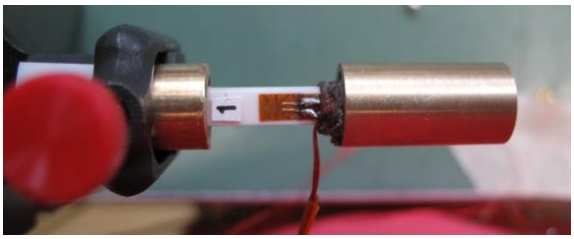
Concrete: Measuring strain profiles on a bending beam.



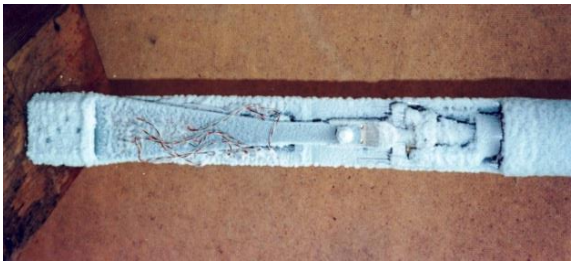
Leadfree solders: Evaluating principal stresses of a lead free soldered printed circuit board during temperature changes in a climatic chamber.



Shape Memory Alloy: RSG with a gauge length of 0.3 mm applied to a cylinder of 5 mm diameter and 5 mm height.



Ceramics: RSG on a tensile test sample.



Measurement of RSG sensitivity at **cryogenic temperatures** down to 4 K.