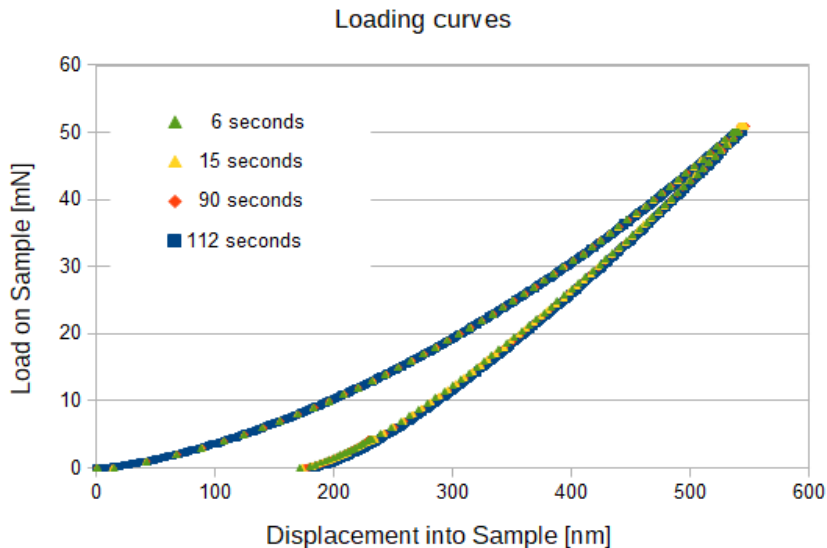


How fast is the sm@rt500 ?

Conventional indentation testing is highly automated and allows for repeated testing for statistical data or on various sample locations. This requires minimal working time, while data acquisition is still time consuming.

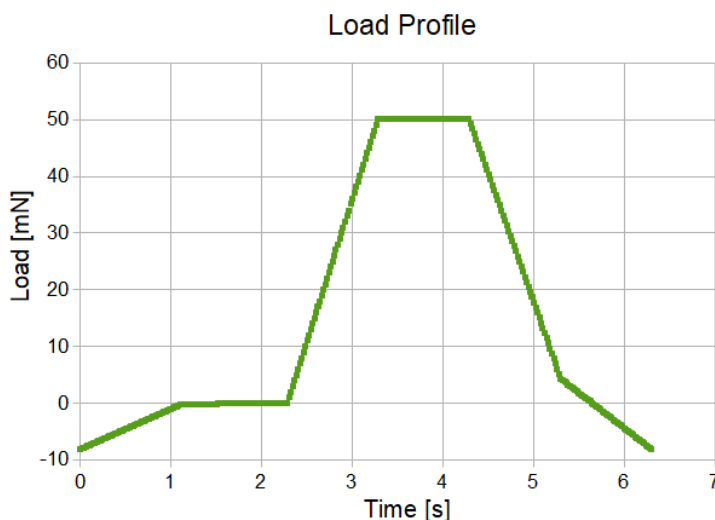
Following ISO 14577 approach time is typically 1 to 2 min, while loading, holding an unload consume 30 - 60s plus drift determination time.



Loading curves into fused silica with different time consumption for approach, loading, and unloading.

Currently material testing is utilizing “fast” indentation tests with testing times of approx. 1 s or below to enable large quantities of tests on an array. This is done at the cost of data reduction, limited analysis and loss of comparability.

The sm@rt500 has already fast testing capabilities in its basic system. The standard process module allows short cycle times of some seconds with the big advantage that the data of each indent remains fully accessible and comparable to conventional testing.

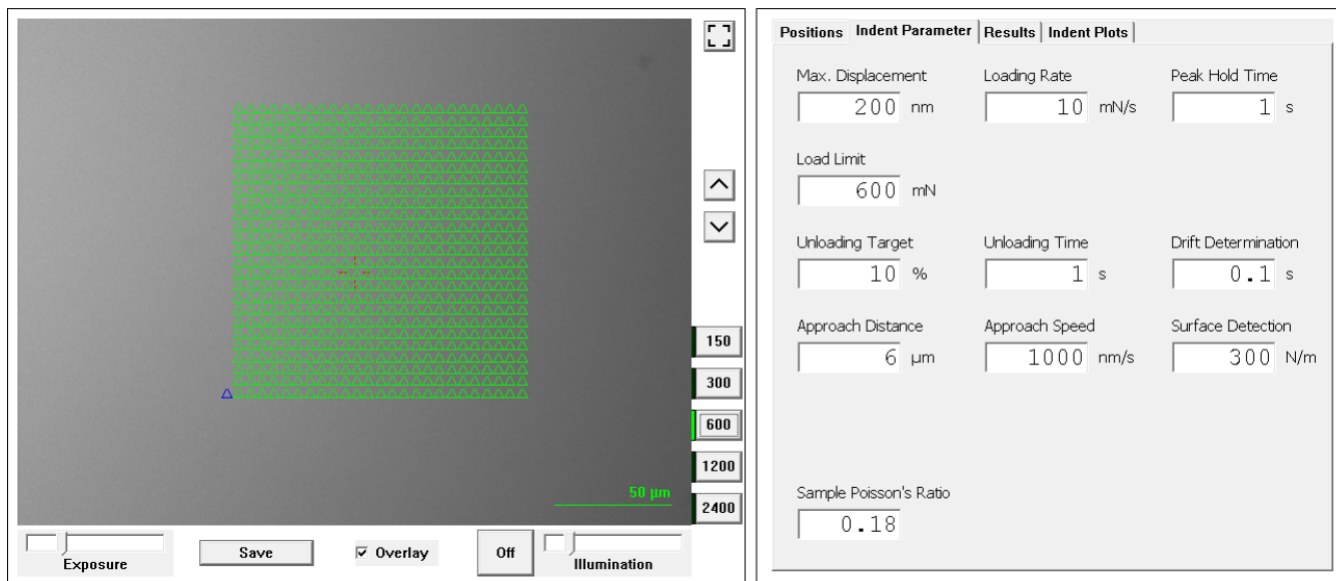


Loading profile for 6 seconds - test,
using standard test module:

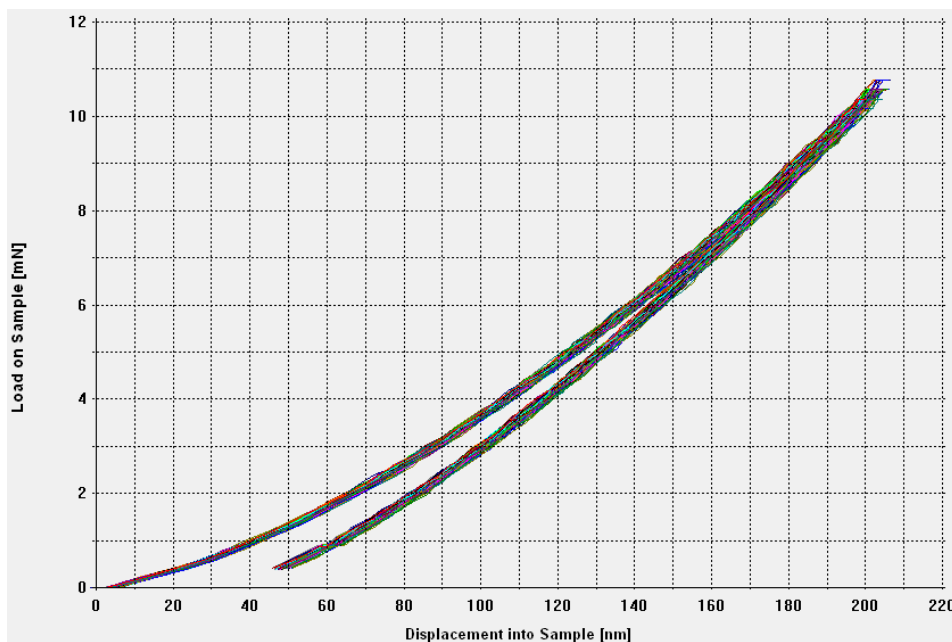
Parameter:

- | | |
|-----------------------|--------------------|
| 1. approaching sample | 50 $\mu\text{m/s}$ |
| 2. final approach | 1 $\mu\text{m/s}$ |
| 3. loading | 50 mN/s |
| 4. peak hold time | 1 s |
| 5. unloading to 10% | 1 s |
| 6. retract indenter | 1 s |

The verification of the short cycle time and its reproducibility on fused silica



Testing on an array of 25 x 25 indents with 5 µm spacing. Test were performed at a fixed loading rate to a displacement limit of 200 nm.



Results:
Average and Std. Dev.

Max. Displacement:
202.3±1.4 nm

Max. Load:
10.40±0.12 mN

Young's Modulus:
71.84±1.01 GPa

Hardness:
8.89±0.24 GPa

The above plot shows 623 out of 625 tests performed into fused silica, only two outliers omitted. The curves demonstrate the reproducibility of the short cycle time execution and the low noise level.

For much shorter measurement cycles - the **sm@rt** speed module will be cumming soon.....