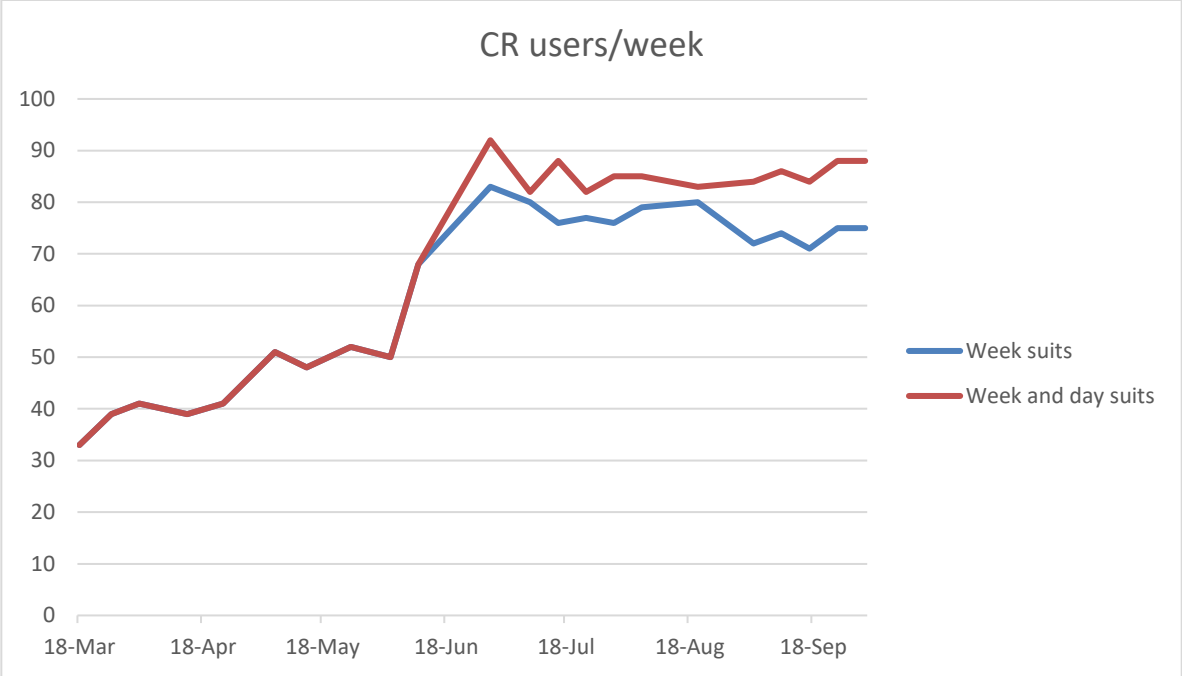
KN NEWS

Dear cleanroom user,

This is the 24th edition of our **Kavli Nanolab Newsletter.**

For more than six months now we are dealing with the Covid-19 measures in our cleanroom. As you know, cleanroom access is regulated and limited; Group leaders have to provide a list of names with the lucky ones who are allowed to enter the cleanroom during a specific week.



(Staff members and pupils are not included in this graph)

In June we were able to start the education/training of new users again, with an average of 10 new users/ month (not added in the graph). For these users we arranged a permanent available suit during their wet bench training period. As you can see, we reduced the total amount of week suits, while at the same time we introduced day suits, giving us more flexibility for those who don't need to be in the cleanroom during the whole week.

To increase the safety level quite some actions were taken: a personal cleanroom suit for everybody, "one-way traffic" in the cleanroom, protection screens at some spots, regulating the amount of users per module, giving pupils a personal face shield, obligatory mouth masks for everybody, on-line equipment training and more frequent cleaning inside the cleanroom of work surfaces, door knobs etc..

This coming period we will not be able to increase the amount of cleanroom users a lot. We will try to arrange more (and cheaper) disposable suits to slightly increase the amount of day users. Arranging enough disposables is still quite challenging these days.

Important to mention is the fact that the wet bench training (not the initial demonstration and final test of course) needs to be given by the mentors again. So Eugene and Pauline will no longer take care of the whole wet bench training. For the mentors' safety, the wet bench trainee will proceed to wear a face shield, while the mentor will keep the 1,5 meter distance as much as possible. We have face shields available for mentors if desired (either for the wet bench training or in the thin film area). They have to take care of the cleaning of the shields *before* and *after* usage themselves.

Finally we want to thank you all for your cooperation during these months. We are aware of the fact that working in the cleanroom nowadays is much harder than in the past. You have to schedule your access, the time you are allowed to spend in the cleanroom is much shorter and you have to deal with waiting times. We wish you all a safe stay in the cleanroom!

On behalf the Kavli Nanolab staff, Marc Zuiddam

Week suits, day suits and suits for a few days….

To enter the cleanroom you have the following options:

Week suits; you are nominated by your PI for a week suit. The distribution of available suits over the user groups is based on the ratio of total amount of user hours of your group in 2019. Every Tuesday after 12:00 we will set up the list of users for the new "cleanroom week" (from Thursday 7:00 till next Wednesday 22:00). These people will be provided with a fabric suit (white), fabric boots and disposable hood and mouth cap. (See picture). On Wednesday afternoon you will receive a mail in which we confirm your access for the coming week.

In case you are not selected for a week suit you have the option to ask for a day suit. At this moment we can only grant 10 day suits a week. Please contact one of the staff members if you want to apply for a day suit. Apply for a one day suit well ahead, if possible (the sooner the better), this will increase your chances of getting one. We will assign you a "KN visitor 1..4" hanger and a pigeonhole for your boots (also KN Visitor 1..4). This hanger can be used during that day. Use a disposable suit, and a disposable mouth cap. *A hood is already attached to the suit, so no additional disposable hood is needed*. You can find these disposable suits in gowning room 1, in the cabinet at the second "overstep" bench.

We also have a few suits available for people who need to enter the cleanroom for a few days. If applicable please contact one of the staff members. For these people we also have a hanger available (normally a hanger number above 60). These suits will **not** be removed at Thursday mornings, so for this option you can reserve a suit from Wednesday till Friday for example. Depending on the availability of suits we will decide if you have to use a fabric or a disposable suit.

Introduction new staff member

My name is Bas van Asten.

I will be responsible for the PVD systems at Kavli. This means all sputtering and evaporation equipment at TU 14, like the Temescal and Alliance Concept sputter machines. For my internship I researched properties of Josephson's junctions made in the Plassys evaporator at the KN lab.

In my free time I like to work on music. I sing and play the piano.

We are still busy hiring a second process engineer. Hopefully we will be able to introduce him or her in the next newsletter.

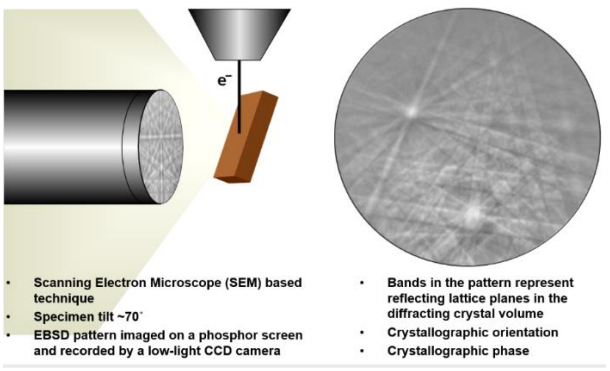
Maintenance week

Don't forget to mark our maintenance week in your agenda: week 48, November 23rd-27th.

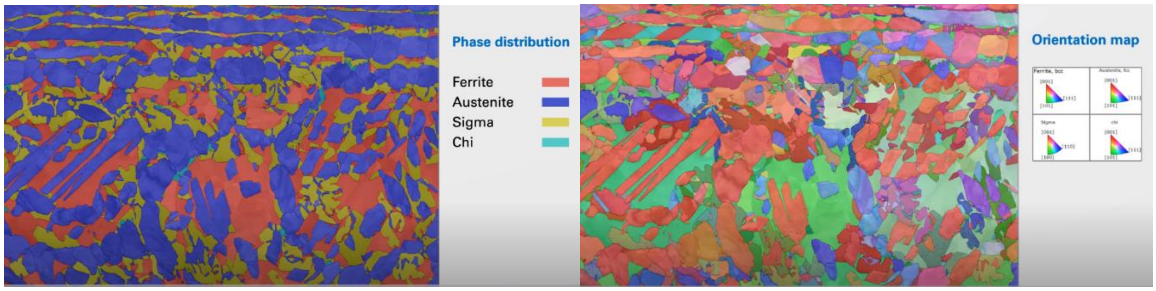
EBSD Detector Nova NanoSEM

The Nova NanoSEM is now equipped with an EBSD detector, it is the Hikari Super Detector from EDAX with high sensitivity and high speed data collection.

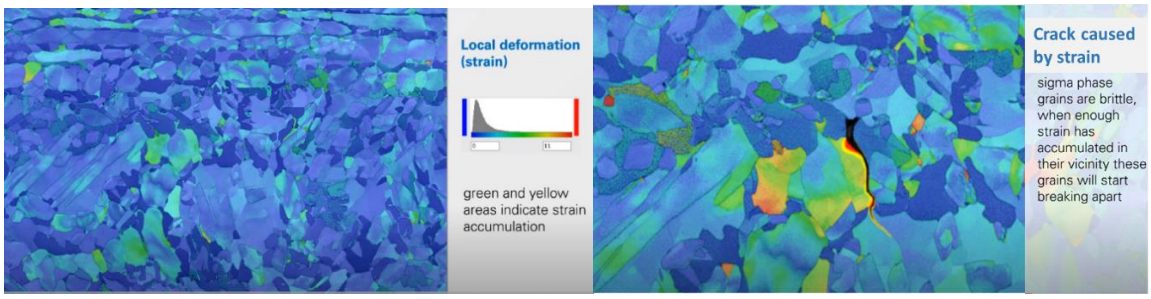
Electron Back Scattering Diffraction (EBSD) is an analytical technique that provides crystallographic information about microstructure of a crystalline or polycrystalline sample. It is based on the diffraction of electrons from crystalline lattice planes near the surface of a specimen irradiated with the primary electron beam of the SEM, the diffracted electrons form a pattern that can be detected with a fluorescent screen. The diffraction pattern is characteristic of the crystal structure and orientation in the sample area where it was generated. Therefor the diffraction pattern can be used to determine the crystal orientation with sub-microns spatial resolution, misorientations, distinguish between crystallographically different phases, characterise grain boundaries, and provide information about the local crystalline perfection.



The high speed of the detector allows the acquisition of large EBSD maps in very short times. The phase distribution map , for example in a duplex stainless steel sample, reveals the presence of hard and brittle intermetallic phases sigma and Chi. The orientation distribution map displays the local crystal orientation.



The local misorientation map can be used to visualize the strain accumulation at the boundary between ferrite and sigma phase grain. In this example, the green and yellow area indicate the strain accumulation.



EBSD can serve as failure analysis and allow to understand the conditions leading to the formation of deleterious phases as Sigma and Chi in a duplex steel for example and reveals the cause of failure.

Microscope re-arrangements

Some of the microscopes have been re-arranged in TU7 and TU8**.**

The new Olympus BX53 optical microscope is placed on stone, to eliminate vibrations at highest magnifications. The Leitz Ergolux camera, which will be equipped soon **with a new Hamamatsu IR camera**, will also be placed on stone.

New critical point dryer

Microsoft bought a new CPD, which has been installed recently. This CPD is meant for III/V samples, while our own CPD is a multi-purpose CPD for all kind of samples. Please contact Eugene and Pauline if you need access. Please also reserve the system in the LDB before use and fill out the logbook afterwards! The old CPD has been removed from the cleanroom. It will be transferred to the EKL cleanroom.

New ‘machine’ in Living Database: Woollam_CompleteEase

We have placed a new machine in the reservation system of the LDB. This machine is merely a computer, but it holds the software and the license, to analyze your data of the Woollam ellipsometer, with CompleteEase. By using this pc (via remote desktop) for modelling and data analyses we reduce the time you have to spend in our measurement room in the cleanroom.

There are 3 rules you have to follow:

- You have to make a reservation in LDB.
- You have to log on with your TUDelft NetID.
- You have to be working on the TUDelft network.

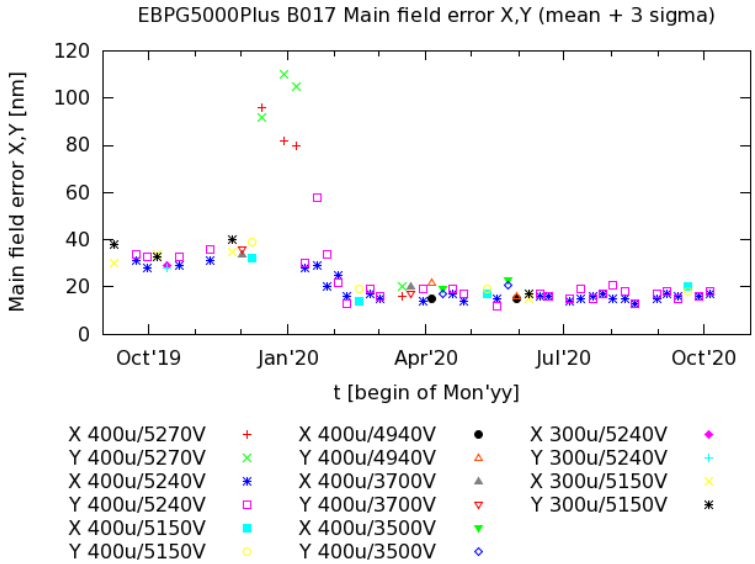
Request access by e-mail addressed to the machine owner. We hope this will help reduce stress on TU14 ½ !

EBPG performance testing

Lots of clean room users use on of our EBPGs (Electron Beam Pattern Generator) for exposing resist layers with a fine (about 2 to 250 nm) electron beam to fabricate their nanostructures.

In order to get well-defined fine structures at the right places the EBPGs need to be in good condition and well-functioning. The high-energetic (100kV) electrons crack molecules floating around in the vacuum system and the residues are deposited on parts where the beam hits substrates or parts of the EBPG's like apertures. The sources of the molecules floating around can for instance be resist materials degassing when being exposed, molecules in outside air that by definition leak into any vacuum system or residual material from machine manufacturing or degassing O-ring vacuum sealings.

The deposited insulating material contaminates apertures and other parts within the electron-optical column and causes charging and subsequent unwanted beam deflection. There is a yearly preventive maintenance to check performance and if everything is well. Most times the column and apertures are cleaned to lower drift values.



There is a standard performance test routine that measures drift by repeated marker searches under various conditions, beam on/off between subsequent marker searches and at different positions within the deflection field. Also deflection within the deflection fields is compensated for non-linearity in order to get good overlay results.

We perform performance test on a regular base, and the graphs with field errors over time are shown on the "Performance test data" page in the EBPGs' online Help manual. The graphs show that the Main field errors usually improve after a maintenance with column clean, and show some degradation over time or severe degradation if something is really wrong.

More graphs will be included in the future.

Another phenomenon caused by the insulating deposit is the fast degradation of measured spot size on calibration markers, especially when using the 200 micron final aperture where spots are really small. For this new calibration markers are used every 1-2 weeks on the EBPG5200.

TU14½

We are proud to announce that our cleanroom has sprouted a new lab facility room! Many thanks to our team: Ron van Viersen, Marco Bakker, Jos Custers and Ron van der Maden, for bringing it into the world.

There has been much debate about the name it should be carrying. There was a real competition, suggested names that did not make it: MIR (Measurement Inspection Room), MaRC (Measurement and Research Cabin), MAIC (Measurement and Inspection Cabin. But since it is comfortably residing in between TU14 and TU15, we decided to lovingly call it TU14½ or labroom 14½.

Also, this number has another meaning:

When you suddenly think of something you want to say, but you don't want to interrupt someone, you would say “Fourteen and a half <whatever>." Where the <whatever> is replaced by something that would remind you later of what it was you wanted to say. (For those of us who would forget if they don't say it right away.)

Retirement

Both Paul Alkemade and Roel Mattern left the Kavli Nanolab to enjoy their retirement. We celebrated Roel’s farewell party in “het Liesbosch” close to Breda, his hometown, with some of the KN staff members. He didn’t want to organize a large farewell party but he asked me to say goodbye to all of you. Every few weeks I meet him in Breda, so we stay in touch and he gets updated about the ins and outs of the Kavli Nanolab.

The farewell party of Paul has not been scheduled yet due to the limitations around Covid-19. He told me he will spend his free time in the classroom again! And of course he will spend more time in the windmill. He is an official miller since quite a few years!

I would like to thank both Roel and Paul for all their effort to make KN Nanolab what it is nowadays and I also want to express my gratitude for their contribution to the nice atmosphere in our group!