LVEM 5 User Profile: Dr. Clemens Mangler

Dr. Clemens Mangler is a senior scientist in the Faculty of Physics at the University of Vienna, working in the Physics of Nanostructured Materials group. His day-to-day work spans hands-on lab engineering and instrumentation (including ultra-high-vacuum systems), programming, and teaching. In his group, the Delong LVEM5 is used extensively for both learning and rapid pre-screening and characterization of nanostructured and low-dimensional materials.

Can you please tell our readers a little bit about yourself?

My name is Clemens Mangler, and I work as a senior scientist at the University of Vienna, Faculty of Physics, in the Physics of Nanostructured Materials group. My work is very broad: Besides electron microscopy on some days, I am soldering, programming or teaching on others, and sometimes building ultra-high-vacuum systems or designing new setups. I enjoy it because it is so versatile – you do not get bored.

Why did you choose to purchase an LVEM instrument?

The purchase decision was made by my former boss, Jannik Meyer, using funding intended for teaching supplies. It is an expensive "teaching supply," but the condition was that it had to support teaching. We still use the instrument heavily for teaching – students really like it – but we also use it for research, mainly to pre-check samples.

What are your favourite things about the instrument, now that you've owned it for some time?

What I like most is that it is quite durable – it has seen a fair share of student "abuse." Service is also much more convenient than with larger machines. If we run into an issue we cannot fix ourselves, we call Delong; they can pick it up in Vienna, take it back to the factory in Brno, and return it repaired about a week later.

Can you briefly describe your recent work and how the LVEM helped you?

We mostly use it for pre-screening. When the instrument was new and I had more time, I used it to generate strain maps in diffraction mode. You could say we were doing 4D-STEM on this small machine before it became widely popular. Today, it is mainly used for teaching and pre-checking. Most of our work involves nanostructured and low-dimensional materials, and graphene and other 2D materials perform very well.

What are other ways you utilise the LVEM in your research?

We inspect materials to detect metallic contamination and damage, such as cracks. We also use contrast variation to observe graphene grain size and shape, and to estimate the number of layers. Additionally, we can detect twisted bilayer graphene using electron diffraction and by imaging moiré patterns in bright-field mode.

Where did you decide to place the instrument?

For a long time, the LVEM5 was located in our main building, adjacent to sample preparation – where we perform exfoliation and CVD growth – because it makes sense to keep it close to the preparation area. When we relocated the preparation lab to our site at Sternwarte, we also relocated the LVEM5. It has been at its new location for a couple of years, again in the prep lab next to the sample preparation facilities.

How hard was site prep?

We mainly needed a suitable desk. It helps to avoid placing it right next to noisy machines that could introduce vibrations; however, in our case, it sits in an ordinary laboratory. We have air conditioning, but no special preparations were required.

How many users in your team are trained on the instrument?

Around 10.

How hard is it to learn the technique?

It is quite easy to learn. We use it in teaching, and once you explain how it works, students can operate it on their own fairly quickly. We even allow unsupervised use. One area where we supervise more closely at the beginning is sample exchange, as you need to be careful not to contaminate the column.

What would you like to say to someone considering purchasing an LVEM?

Go for it – depending on what you want to do. If you are working with thick intermetallics, you may want to reconsider your approach. However, for polymer samples or low-dimensional materials, it is a truly exceptional instrument.

How did you raise the funding for the purchase?

It came from teaching-related funding, but I do not know the details completely because my boss was responsible for securing the funds, and I am responsible for maintaining the instrument. My understanding is that it was special funding aimed at improving teaching through special equipment purchases.

What is the most exciting moment you've had using the LVEM so far?

I remember the first diffraction images on nanotubes – that was very exciting. My first diffraction image on graphene was also a great moment. And when I finally got my (very ugly) mapping code working for strain maps, that was fun too.

What advice do you have for someone who would like to develop a similar course at their institution?

Print out the ray diagrams from the manual – they are excellent. Explain how everything works using those diagrams, then show students which buttons correspond to which functions. After that, give them time to explore and try things on their own. I deliberately leave them space to experiment independently.

Do you have any advice for students considering careers in STEM (Science, Technology, Engineering, and Mathematics)?

Go for it – it is awesome. And do not be scared that it might be complicated. If you spend time with it, you will usually find it is not as complicated as it first seems.

Is there a piece of leadership advice you'd like to share with anyone pursuing a STEM career?

Do what is fun.

What are your thoughts on the post-sale customer service and support?

So far, we have been very happy. Support is responsive, and if a serious issue arises, they can return the instrument to the factory for repair within one to two weeks. I especially appreciate Petr Štěpán – he knows the instrument extremely well, and it is always interesting to talk with him about the specifications and electron microscopy more broadly.