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Peer review

The habilitation thesis of Dr. Jelínek selected one important recent part of his very successful scientific work, namely high-resolution scanning probe microscopy (SPM) for chemical analysis of organic molecules on metals and semiconductor surfaces. The work presented in the thesis is closely related to his group's work and combines jointly experiments with theoretical modeling and simulations.

The presented papers continue and develop further the exciting line of research initiated originally by Ruslan Temirov, Leo Gross and their colleagues who were the first to obtain clear images of molecules on surfaces showing the characteristic sharp edges mimicking the molecular structure. Most of the success was due to use of tips functionalized by Xe atoms and CO molecules opening up a completely new line of research which dominated the SPM scene for the last few years. Surprisingly, these new experimental techniques almost completely factored out quantum chemistry and made the Pauli repulsion the single most important factor in understanding them. And this is where Dr. Jelínek and his group made the largest theory contribution by introducing the so-called probe-particle (PP) model which takes into account the flexible nature of the functionalized tip. This simple model was further refined by adding the electrostatic forces and applied to a range of techniques such high-res AFM, high-res STM, combined AFM/STM, IETS-STM (inelastic electron tunneling STM) and different molecule-surface systems. In addition, part of the work solves the problem of high-temperature (liquid nitrogen and even room temperature) imaging and of on-surface chemical reactions.

The selection of publications in the habilitation is truly excellent: Nat. Chem., 2× Nat. Comm., ACS Nano, 3× PRL, 2× PRB, and J. Phys. Chem. C. These and the other publications also attract well-above-the-average number of citations making for an impressive scientometry, especially taking into account also the age of Dr. Jelínek.

With such an outstanding collection of papers it is almost inappropriate to raise any criticism. Therefore, I would rather like to ask about the future of these techniques and the direction the high-res SPM may go in the next years. As much as these systems are exciting, the

inventory of interesting novel organic molecules, surfaces and their combinations will be exhausted at some point. Will it be magnetic systems, molecular magnets, functionalized 2D materials or friction/lubricants or nano-machines which will dominate the SPM, sticking just to materials science?

From the above it is clear that I am very positive about the habilitation. In fact, based purely on scientometry, I would have presumed inauguration, rather than habilitation proceedings. I wish to add that Dr. Jelínek's SPM group at the Inst. of Physics of the Czech Academy of Sciences is a group of truly international stature which enjoys excellent national and international reputation. Judging by the scientific achievements of Dr. Jelínek only, I have no doubt that the habilitation thesis satisfies all the requirements for a successful habilitation.



prof. Ing. Ivan Štich, DrSc.