PhD student:

Momentum-resolved Scanning Transmission Electron Microscopy of ultrathin alloyed metal nanowires

Advertising institute: Forschungszentrum Jülich (Research Centre Jülich), Peter Grünberg Institut, Ernst-Ruska-Centre-1 - Physics of Nanoscale Systems
Reference number: D024/2018, Physics

Internet Link:
http://www.fz-juelich.de/SharedDocs/Stellenangebote/_common/dipldok/d024-2018-erc-1.html?nn=718260

The **Ernst Ruska-Centre (ER-C) for Microscopy and Spectroscopy with Electrons** at **Forschungszentrum Jülich** is a national facility dedicated to research at the frontiers of electron microscopy and materials science. In cooperation with the **RWTH Aachen** it hosts up-to-date infrastructure including versatile aberration-corrected electron microscopes. The research team at ER-C is looking for a

PhD student

with a strong background in physics.

Start: **06/2018** (or as soon as possible thereafter).

Scientific background

The exceptional physical properties of metallic nanowires indentify them as ideal candidates for catalysis, bio-/electrochemical sensors, nanoelectronic interconnects as well as optical and plasmonic applications. To enhance the stability of ultrathin Gold nanowires (diameter 1-2nm), alloying with Cu, Pt or Pd is one promising strategy. However, this often leads to a phase-separation which must be understood at the atomic scale. The excellent resolution of aberration-corrected scanning transmission electron microscopy (STEM) of 50pm nowadays allows for the view inside atoms and is an outstanding tool for compositional quantification at the atomic level. While established STEM techniques collect only the "Z-contrast" signal formed by electrons scattered to high angles, a new imaging mode called *momentum-resolved* STEM provides access to the wealth of details over the whole diffraction space including low-angle scattering.

Project description

A quantitative understanding of relativistic low-angle electron scattering by comparing experimental and simulated momentum-resolved STEM signals is to be achieved. In particular, current approaches for simulating the angular distribution are inherently based on elastic scattering whereas strong hints exist that inelastic interactions, e.g., plasmonic excitations, cause a yet unexplored energy dependence of the scattered intensity. Developing, testing and implementing theoretical approaches to close this gap is a fundamental step to be accomplished with national and international partners working on scattering theory. This knowledge together with the acquisition of cutting-edge experimental data then provides the basis for the compositional quantification of alloyed Gold nanowires. This will shed light on their phase stability, for example the formation of core-shell structures after post-synthesis thermal treatment. The vivid cooperations between the ER-C as a user facility and national/international university partners working in the fields materials, chemical and biological science allow for the application of the developed approach to many topics at the frontiers of electron microscopy research.

Your profile

The successful candidate should have a master degree in physics. A background and strong interest in scattering theory, and/or experiences in electron microscopy are desirable, as well as programming experiences in, e.g., Matlab. Both your written and spoken English should be very good. Most importantly, you explore uncharted territory with enthusiasm, develop and follow your own ideas and work autonomously in close interaction within a team.

Our profile

You will be part of the *more*STEM research group dedicated to the theory and practice of momentum-resolved STEM. We provide access to state-of-the-art computing facilities and aberration-corrected

transmission electron microscopes equipped with ultrafast detectors of the latest generation. We welcome you as a member of a highly motivated team providing feedback and expertise in the multiple facets of electron microscopy and materials science. The position comes with a competitive salary and is limited to 3 years.
Forschungszentrum Jülich aims to employ more women in this area and therefore particularly welcomes applications from women. We also welcome applications from disabled persons.

Please address your electronic (PDF) application (in English or German) including curriculum vitae, a description of research background and interests, and a copy of relevant certificates to

Dr. Knut Müller-Caspary
- *more*STEM group leader -
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