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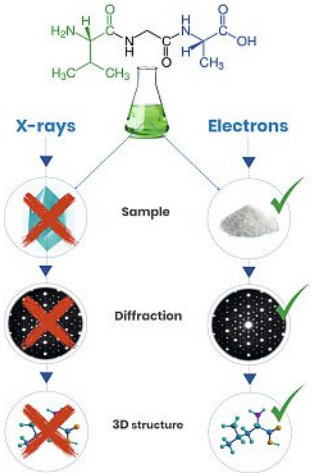
A novel device to get accurate molecular structures from nano-crystalline powders

In the past two years, various achievements using Electron Diffraction (ED) techniques have been made in the fields of pharmaceutical compounds, macromolecules, polymorphism, material sciences, geological sciences, archaeological sciences, energetic materials and many others. Such experiments are done in a (modified)-Electron Microscope (EM). Since the realization of such experiments still requires plenty of expertise and efforts, it cannot be applied on daily basis. Pioneers in the field of Electron Diffraction (ED) all agree that a dedicated device for the realization of such experiments would be of great advantage to the crystallographic community, but such an instrument doesn´t exist up to now.

ELDICO Scientific – the Electron Diffraction Company – is a Swiss hardware company founded in 2019 and located in the Innovation Park Innovaare at the Paul Scherrer Institute (PSI), one of the world's leading research centers for natural and engineering sciences.

ELDICO develops, produces and sells electron diffractometers for the analysis of solid compounds, enabling industrial and scientific researchers to characterize hitherto unmeasurable nano-crystalline systems.



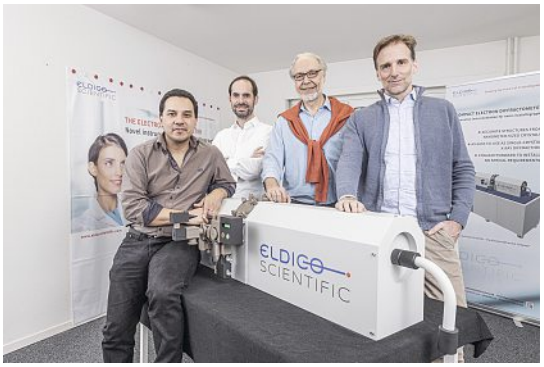
Conventional methods (X-ray) fail because they require big crystal sizes, which are often difficult or even impossible to produce. An electron diffractometer for 3D-structural analysis can deal with nano-crystalline compounds.

Advantages of a dedicated electron diffractometer

By using electrons instead of X-rays as a source of radiation, nano-particles (4–5 orders of magnitude smaller in volume) can now be examined. Therefore, the molecular structure of a nano-crystal can easily be obtained. Troublesome (or sometimes impossible) crystallization experiments are avoided, saving time / money and efforts to the industrial and scientific researchers.

Compared to a (modified)-TEM device, data acquisition goes smoothly and can be performed by any trained operator without having mandatory knowledge and experience on EM devices.

With an electron diffractometer, the e- beam intensity and dose are optimized in such a way that the radiation damage of sensitive organic samples is reduced (one of the major problems of an EM). With a precise and accurate rotation stage (goniometer) for the sample, the nano-particle remains always within the e- beam, facilitating the data acquisition and resulting in much better data than any available EM device. With an almost perfect rotation and a wider-angle range (–70° to 70°), data analysis and data quality become comparable to well-known and established X-ray diffraction experiments. Crystallographic software, optimized for electrons and including data treatment using dynamical effects, makes it possible to get very good quality 3D-structures with R_1 and wR_2 acceptance values – as qualitative as with X-ray crystallography.



ELDICO's achievements

The use of electrons combined with the continuous rotation method used in X-ray crystallography was nominated by SCIENCE for "Breakthrough of the year 2018". Founders of ELDICO were among the scientists involved in the publication awarded for this disruptive technology.

After the establishment of the company, various awards and prizes have been received. Some of the most important include: Swiss Innovation Challenge finalist (2019), Venture Kick awards (Phases 1–3, 2019–2020), ZKB-Technopark Pionierpreis (2020) runner-up, 10 Swiss Start-ups to watch in 2020, European grant (No. 889359), and very recently a R&D 100 award.

Industry and research facilities will benefit from such a device. The fields of inorganic, organic and biochemistry, material sciences and others will have access to a dedicated device for 3D-ED experiments for nano-crystalline substances. This disruptive technology will change the way structural characterization is done for the Pharmaceutical, Agrochemical and Chemical companies and research facilities.

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