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Neutron Depth Profiling at the PGAA facility of MLZ

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Neutron Depth Profiling (NDP) is a non-destructive, isotope-specific, high-resolution nuclear analytical technique, which is often used to probe profiles of lithium, nitrogen, boron, helium and several additional light elements concentration in different host materials. The N4DP experiment is located at the Prompt Gamma Activation Analysis (PGAA) facility of Heinz Maier-Leibnitz Zentrum (MLZ), which provides a cold neutron flux up to $5 \times 10^{10} \text{ s}^{-1} \text{ cm}^{-2}$. When a neutron is captured by a ${}^6\text{Li}$ nucleus, the system emits an alpha particle at a well-defined energy. The loss of the charged particle traveling through the host material is related to the depth of origin at a resolution level up to a few ten nanometers.

After a short introduction to the existing N4DP facility, we will present the status of the ongoing upgrade towards its full functionality to study the lithium-ion concentration gradient in energy storage systems, i.e. Li-ion batteries. Here, NDP reveals new insights into the evolution of the lithium accumulation in different silicon-graphite anode compositions. The evolution of immobilized lithium could directly be measured, which is one of the main causes of battery lifetime limitation. This project is supported by the BMBF, Contract No. 05K19W08.

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