Interested to work on an interdisciplinary project at the interface of new NMR technologies and batteries?

**Using microscopic diamond NMR for probing batteries**

Recent experiments have shown that defects in diamond can be used as quantum sensors for detecting NMR (nuclear magnetic resonance) signals from tiny volumes down to a single molecule!

This new technology will be used here for NMR spectroscopy to probe batteries in situ. In particular, we would like to monitor ion diffusion in batteries on the microscopic scale, which is of central importance for their function. Pulsed-field-gradient (PFG) NMR is a common method used for measuring atomic and molecular diffusion. However, it cannot detect low diffusion coefficients such as they occur in batteries due to limited available magnetic gradient strength. In contrast, the microscopic NMR detection volume of NVs will allow the application of several orders of magnitude high magnetic field gradients over the sample volume. This will not only make it possible to measure very low diffusion coefficients but also to monitor unprecedented ultrashort diffusion length on the nanometer range. This will result in the determination of ion diffusion coefficients at interfaces, which cannot be obtained with current methods.

**Tasks:** Design and fabricate diamond sensor with integrated gradient coils for probing batteries.

**Techniques:** 3D-printing, electronics, NV-quantum sensing, NMR, chemistry

**Skills:** Ideally some knowledge of batteries and or NMR spectroscopy.

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