ESRF	Experiment title: Spinel/rGO aerogels as anodes in Li-ion batteries: unrevealing the fundamentals of remarkable enhancement of specific charge upon cycling	**Experiment number**: 01-02 1100
Beamline: BM01A	**Date of experiment**: from: 29.04.2016 to: 02.05.2016	**Date of report**: 16.09.2016
Shifts: 18	**Local contact(s)**: Wouter Van beek, Dmitry Chernyshov	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Xi Chen*, Christoph Findler*, Pascal Oberholzer*, Dorota Koziej*

ETH Zurich, Department of Materials, Laboratory for Multifunctional Materials, Vladimir-Prelog-Weg 5, 8093 Zurich, Switzerland

This is a preliminary report. Data analysis is still in progress.

Report:

In our previous work, we have successfully fabricated a spinel/rGO aerogel as anode material for lithium ion battery. The porous network sturcture constructed by spinel nanoparticle embeded rGO nano sheets enable fast ion diffusion during charge and discharge and buffer the volume change of the nanoparticles at the same time. Those merits of the aerogel material lead to high specific capacity and good cyclic stability. However during cycling of the $CoFe_2O_4$/rGO material we observed some abnormal electrochemistry performance, specifically the increasement of the specific capacity after less than 50 fast charge cycles.

The alingment of the batteris for the transmission PXRD measurements took 1 shift, in situ measurements 15 shifts, refernces 2 shifts. During the beamtime we could successfully address the following questions::

- Measure the phase change of the $CoFe_2O_4$ nanoparticles first discharge cycle with low current rate (0.1 A/g) to study the different stages of lithium ion insertion and spinel reduction during first cycle.
- Measure the phase change of the $CoFe_2O_4$ nanoparticles in following few slow cycles to see if $CoFe_2O_4$/rGO has the same behaviour compared to the pure $CoFe_2O_4$ composed anode.
- Measure the fast cycles when the abnormal capacity increase occurs to see if there is new phase produced.
- Also try to see if there is any change in rGO during cycling.

We alternatively measured PXRD patterns at 5 different spots. We did not observe any beam damage. The electrochemical performance of the battery used for the in situ experiment is alike the one of the batteris tested without X-ray beam.