



Kinetic limitations of a graphite electrode

Corentin Renais, Maxime Servajon, Marta Mirolo, Fannie Alloin, Claire Villevieille

► To cite this version:

Corentin Renais, Maxime Servajon, Marta Mirolo, Fannie Alloin, Claire Villevieille. Kinetic limitations of a graphite electrode. 74th Annual Meeting of the International Society of Electrochemistry (ISE 2023), Sep 2023, Lyon, France. <hal-04289288>

HAL Id: hal-04289288

<https://hal.science/hal-04289288v1>

Submitted on 16 Nov 2023

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HAL Authorization

Kinetic limitations of a graphite electrode

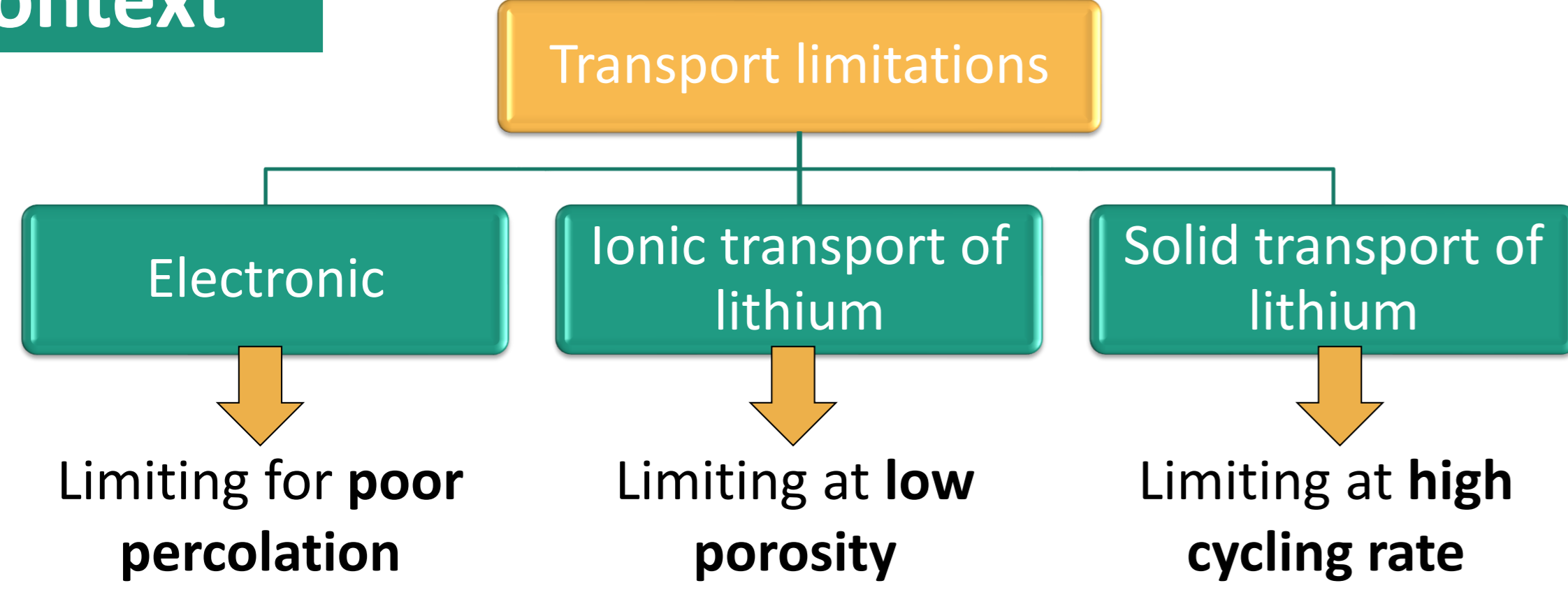
Corentin RENAIS ^a, Maxime SERVAJON ^a, Marta MIROLO ^b, Fannie ALLOIN ^a, Claire VILLEVIEILLE ^a

^a Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, Grenoble INP, LEPMI, 38000 Grenoble, France

^b ESRF, The European Synchrotron, 38043 Grenoble, France

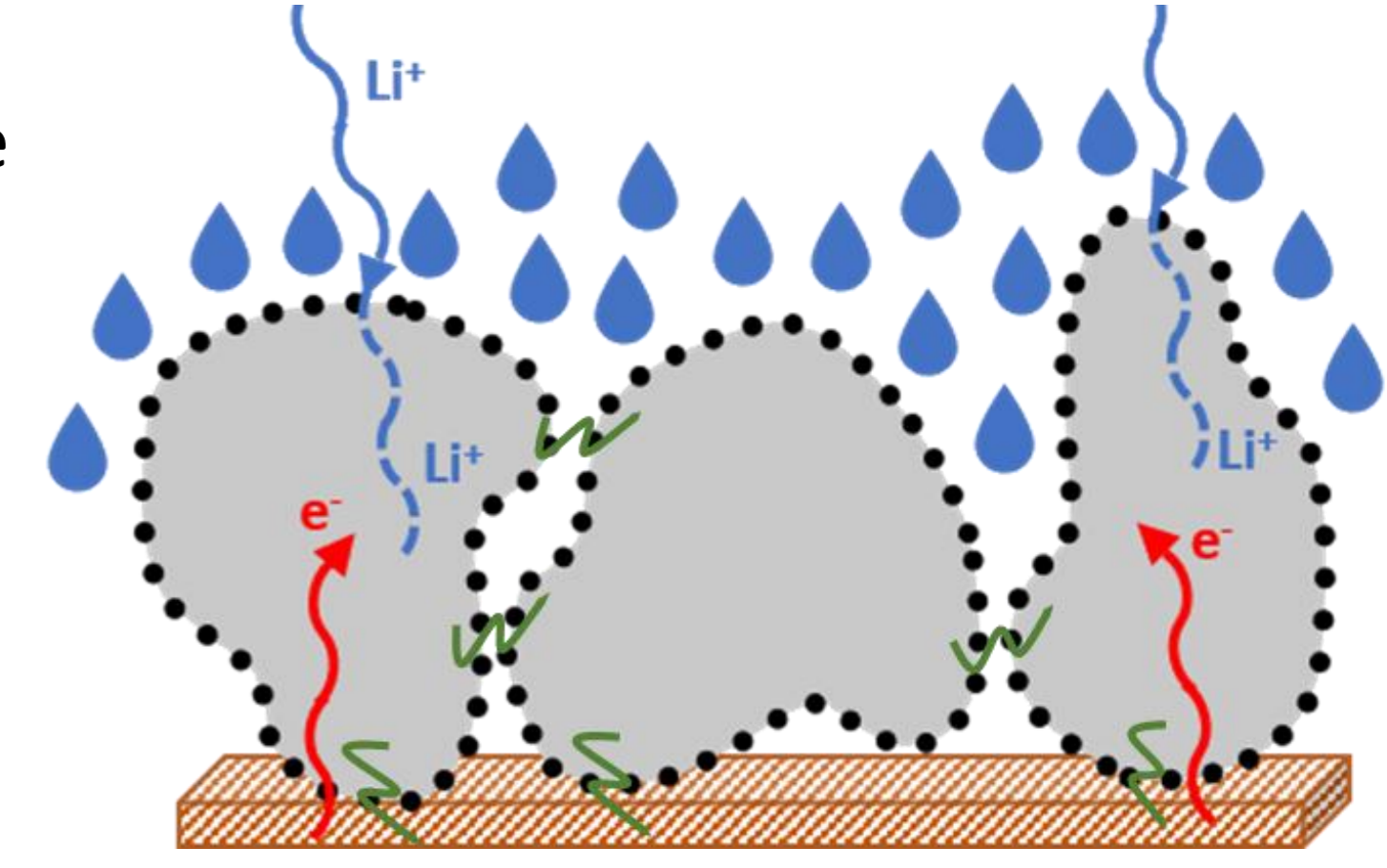
corentin.renais@grenoble-inp.fr

Context

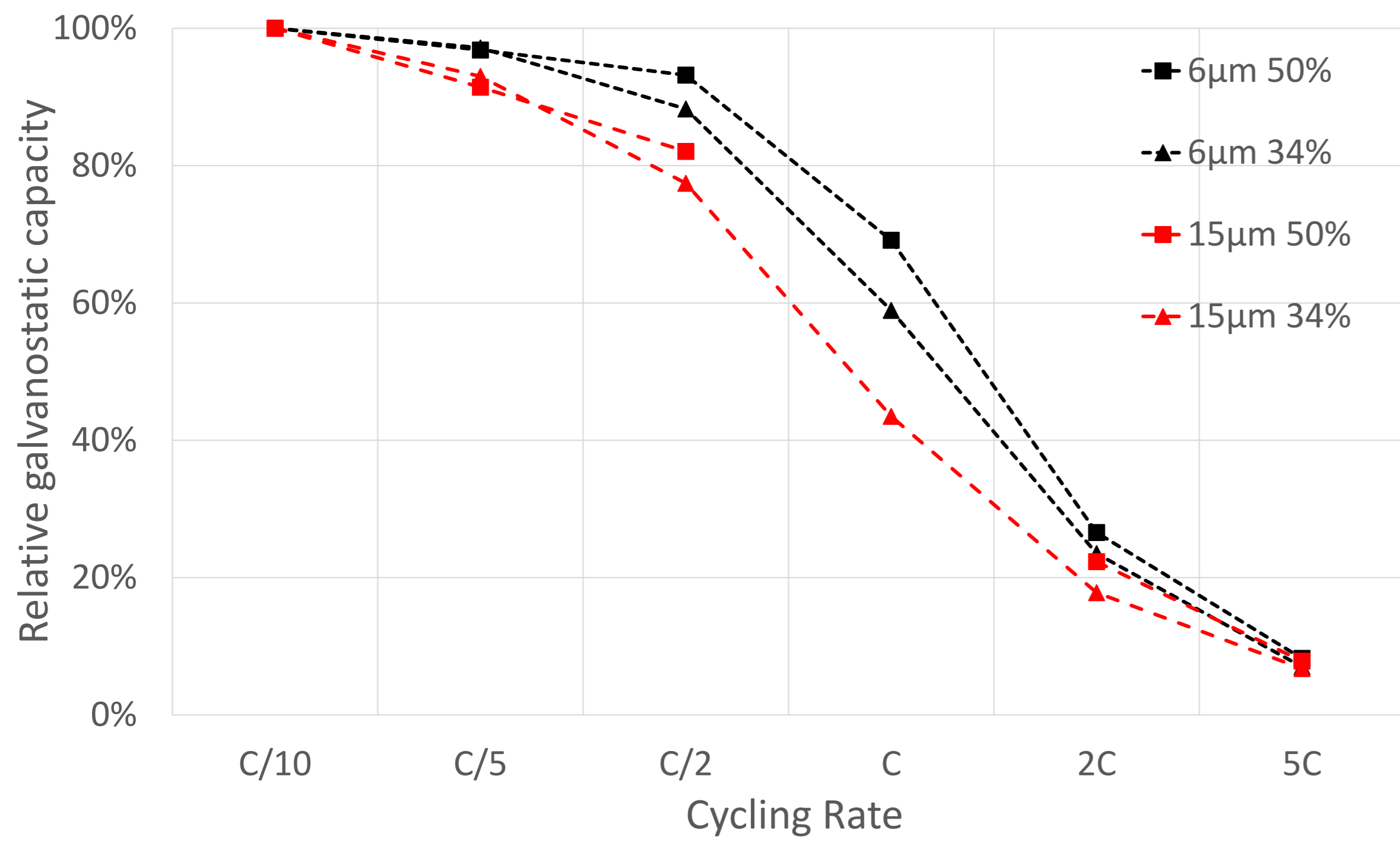


Every system has its limitations ... **kinetic limitations** are the one limiting Li-ion batteries, especially the graphite electrode !

Which transport processes are limiting the system ?



In-lab insight of kinetic limitations



❖ Decreasing the porosity complexifies **electronic** and **ionic** transport

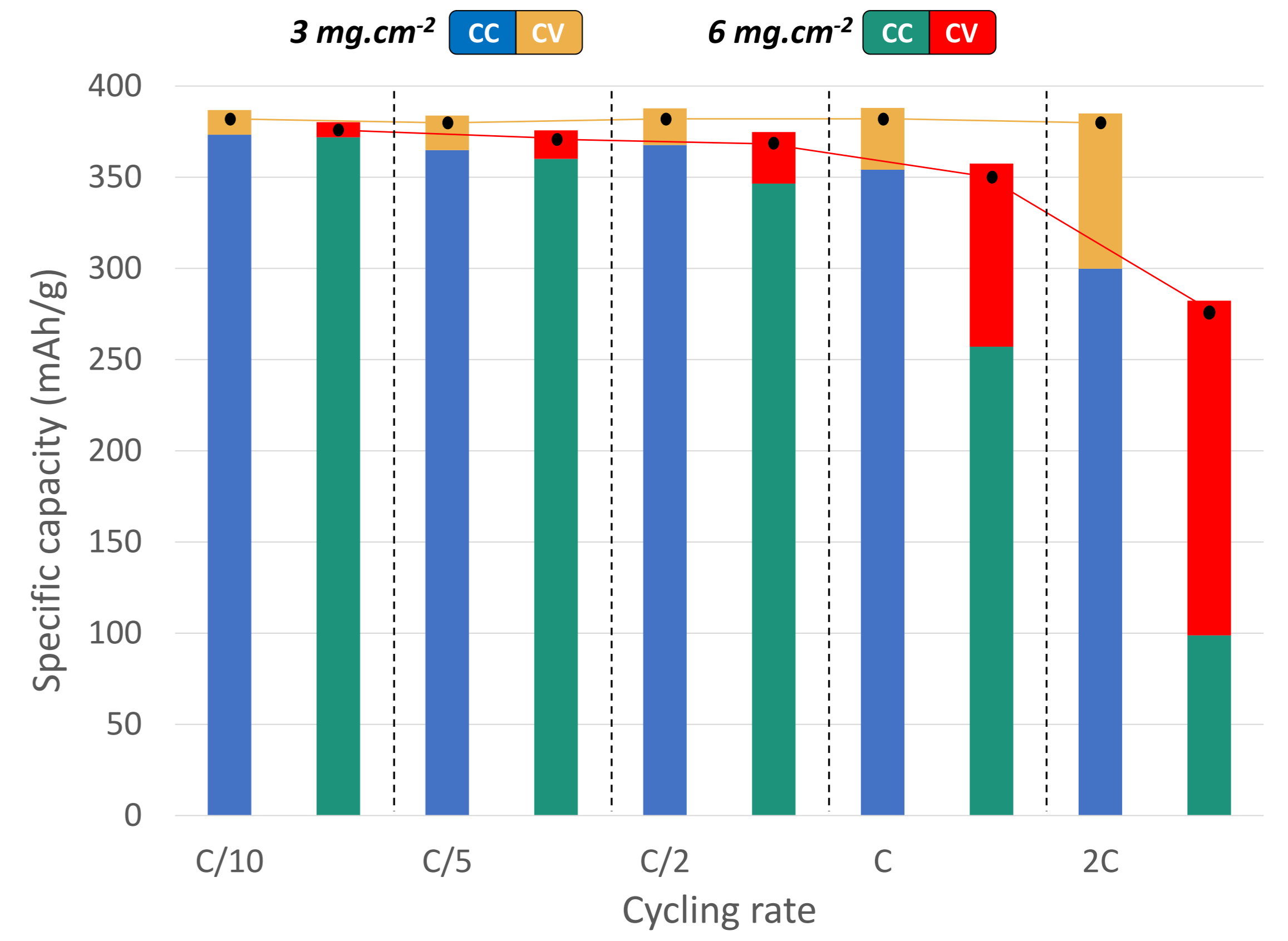
CC – CV cycling

- 1st : **galvanostatic step (CC)**
→ 1,2V – 10 mV vs Li⁺/Li
→ sensitivity to **kinetic** limitations
- 2nd : **potentiostatic step (CV)**
→ 30 min at 10 mV vs Li⁺/Li
→ **thermodynamic** conditions

Ionic transport

Electronic transport

Which one is limiting ?

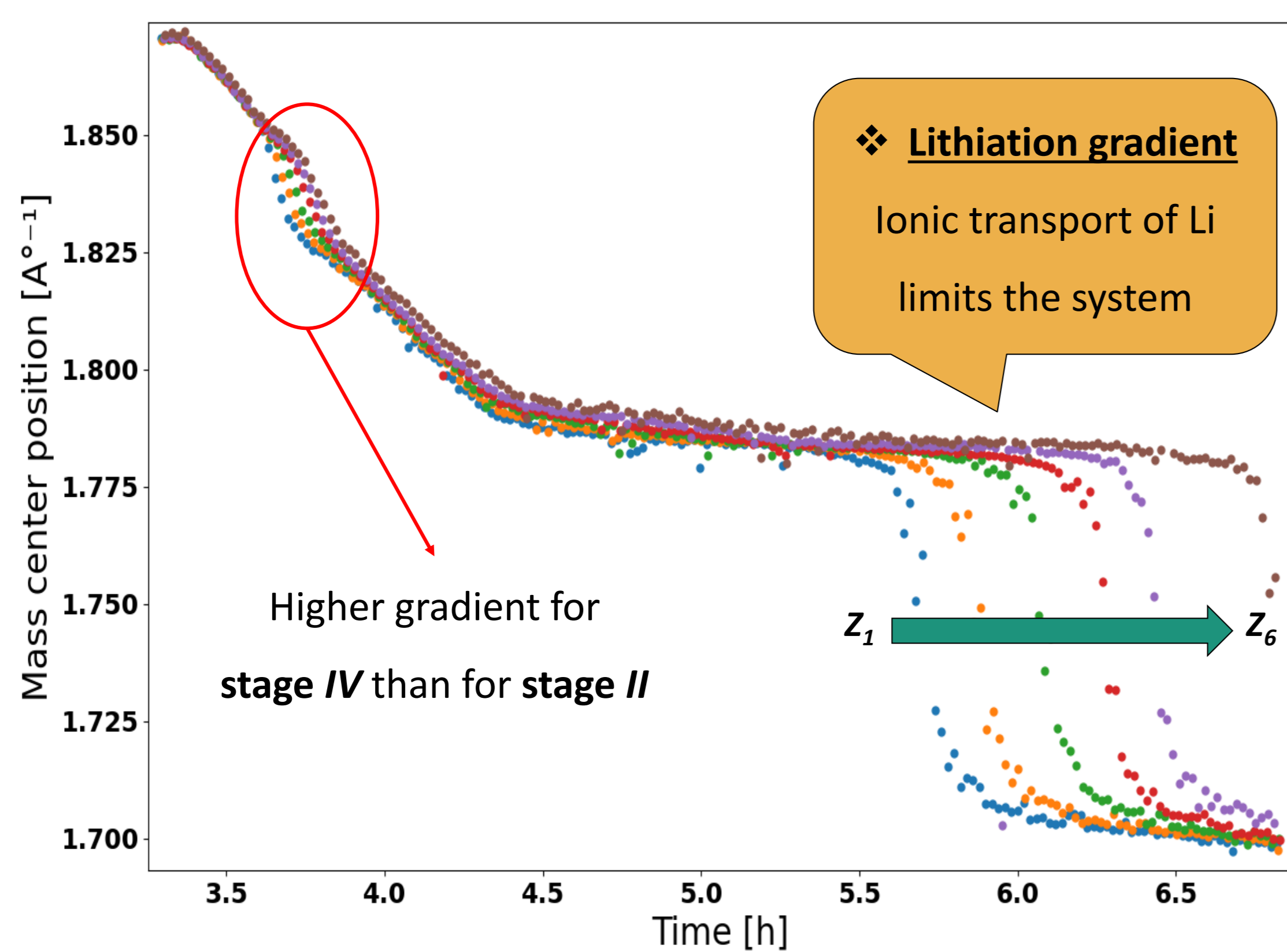
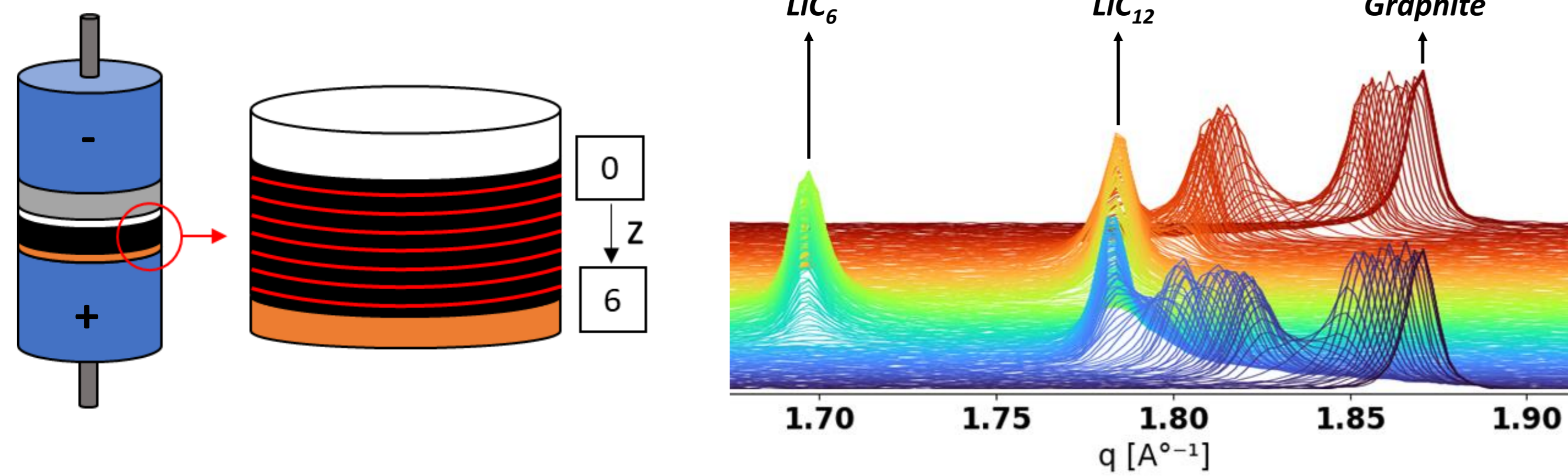


❖ Increasing the loading impacts **electronic** and **ionic** transport

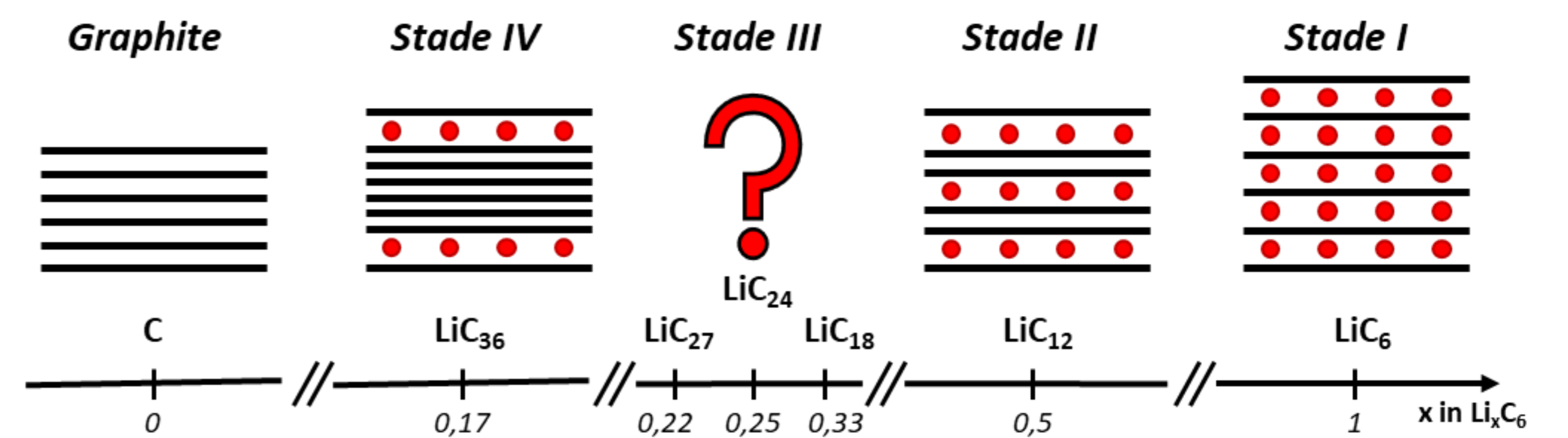
Synchrotron insight of kinetic limitations

ID31 – HIGH ENERGY BEAMLINE FOR BURIED INTERFACE STRUCTURE

- Operando** measurement with 220 000 diffractograms collected
- Combination of electrochemical cycling and **WAXS** analysis
- Electrode of **6 µm** graphite particles at **50%** of porosity and **6 mg.cm⁻²**



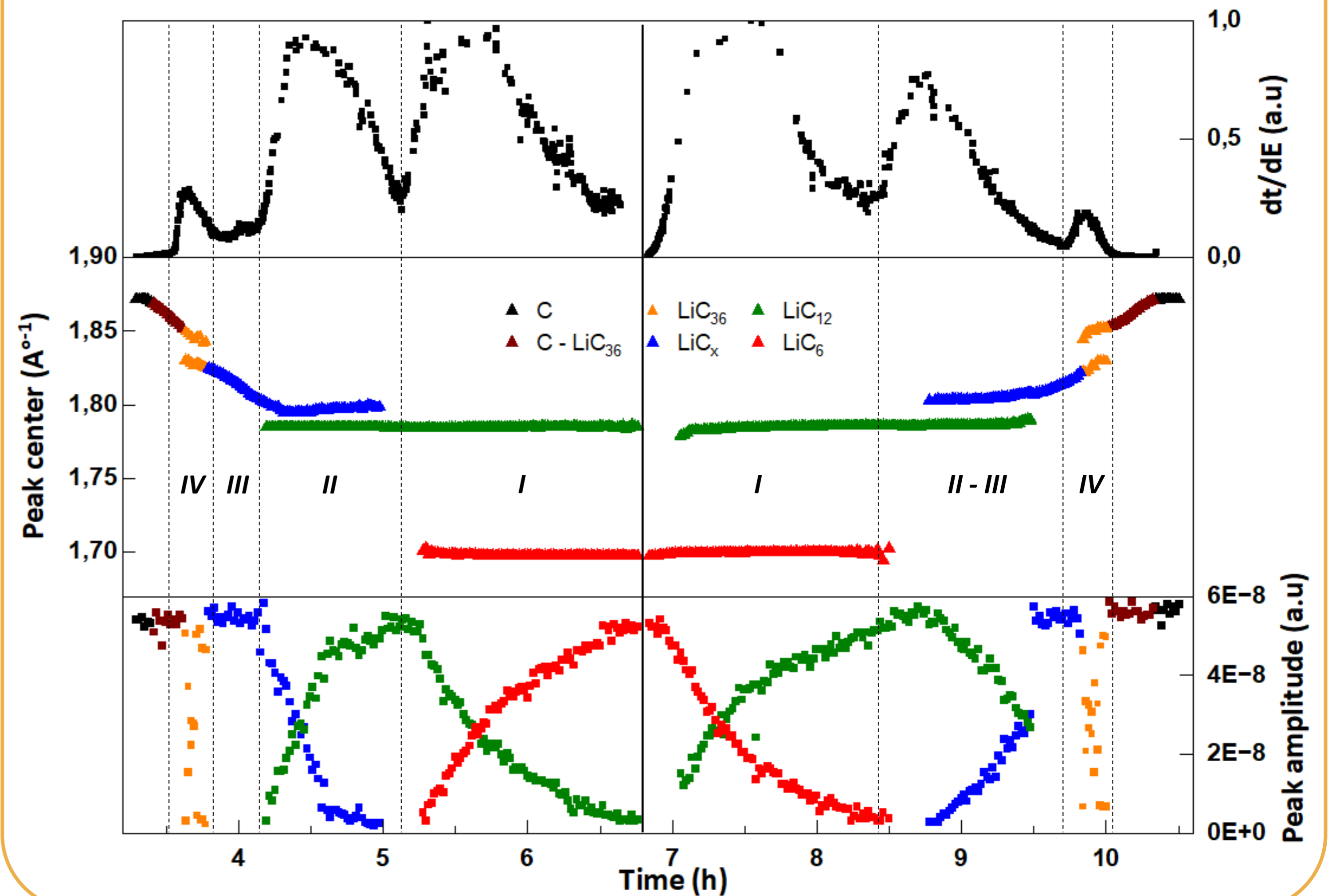
Additional characterization



Peak characterization by fitting

- Peak center
- Amplitude
- FWHM

- ❖ **Biphasic** behaviour for stages IV, II and I
- ❖ **Liquid like** behaviour for stage III



Overview

❖ **Ionic limitation** of the electrode at a porosity of 50%

→ What about the limitation for **higher porosity** ?

❖ GITT experiment to determine **Li coefficient diffusion** for each stage

❖ What about the **rate capability** ?