



HAL
open science

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-04289288>

Submitted on 16 Nov 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Kinetic limitations of a graphite electrode

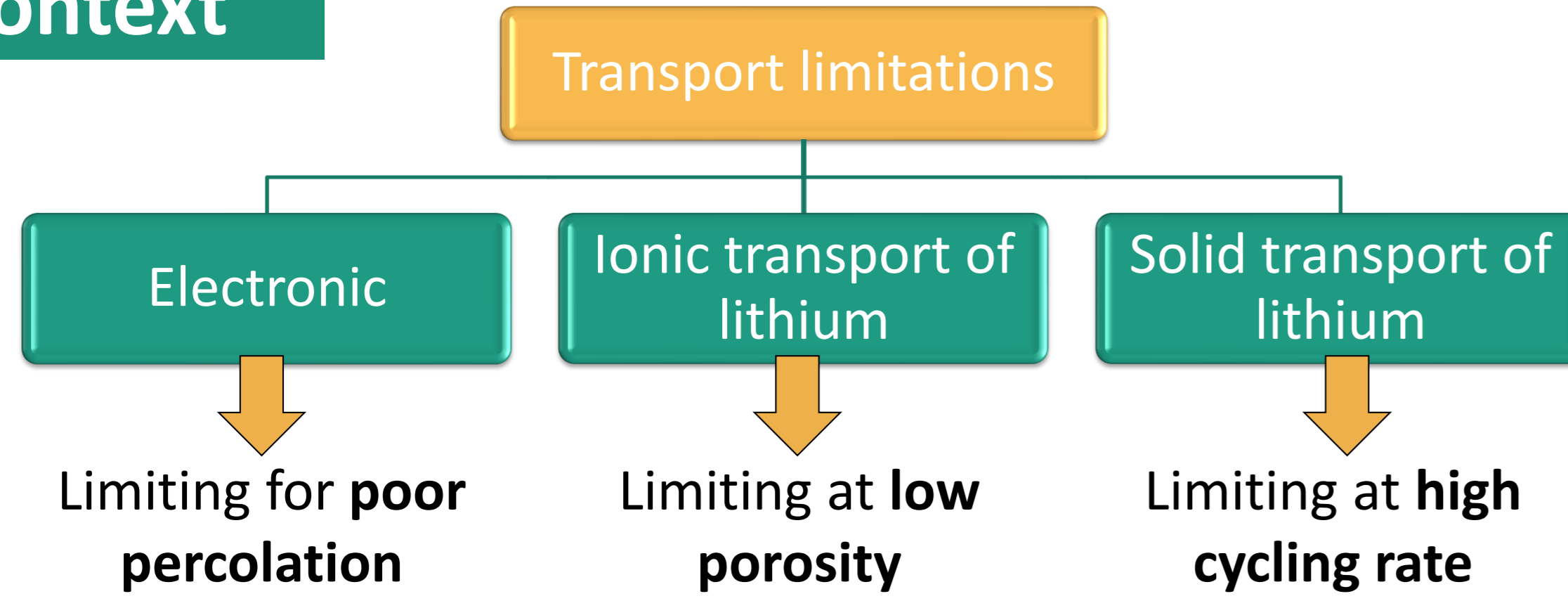
Corentin RENAISS^a, Maxime SERVAJON^a, Marta MIROLO^b, Fannie ALLOIN^a, Claire VILLEVIEILLE^a

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

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

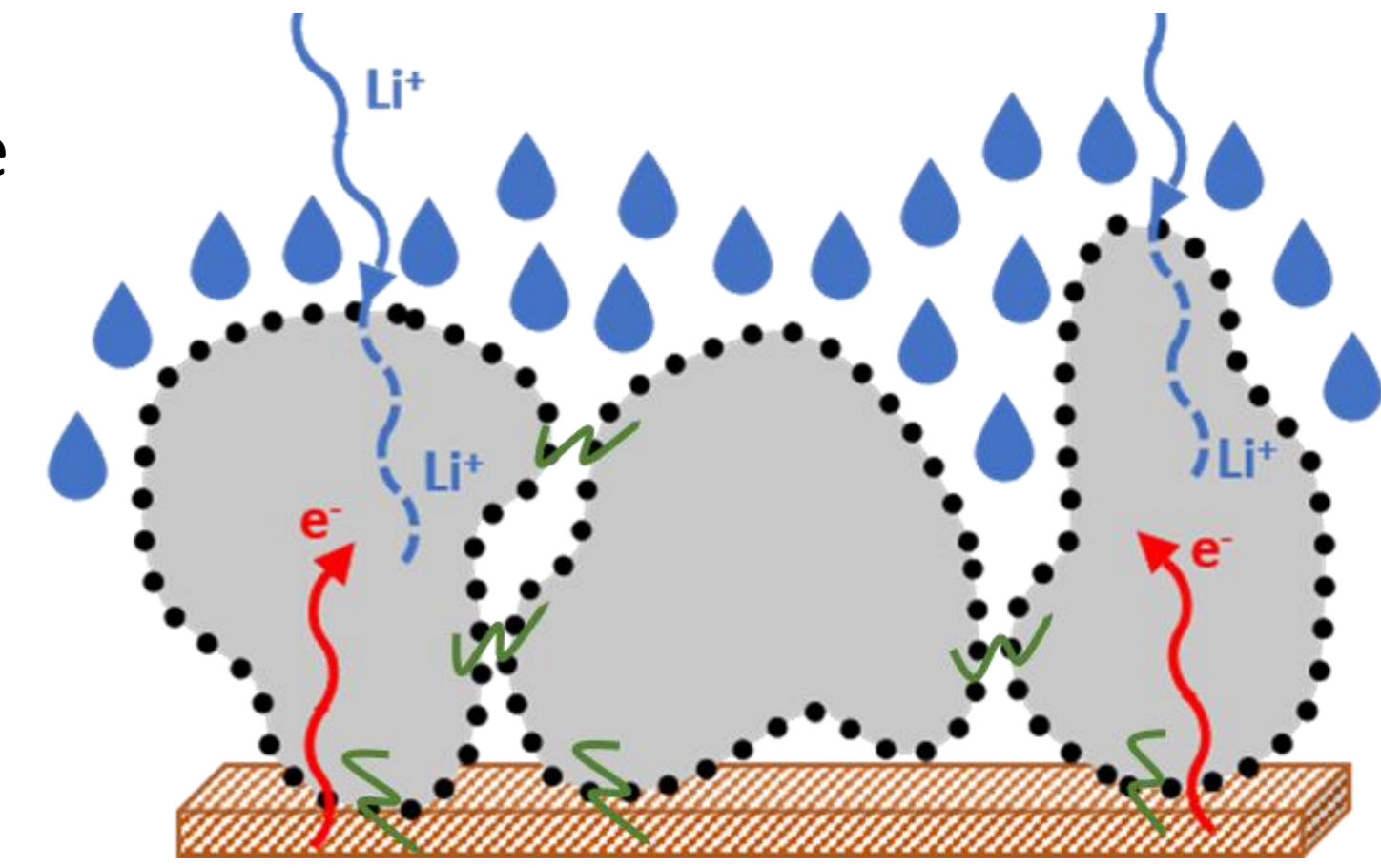
corentin.renais@grenoble-inp.fr

Context

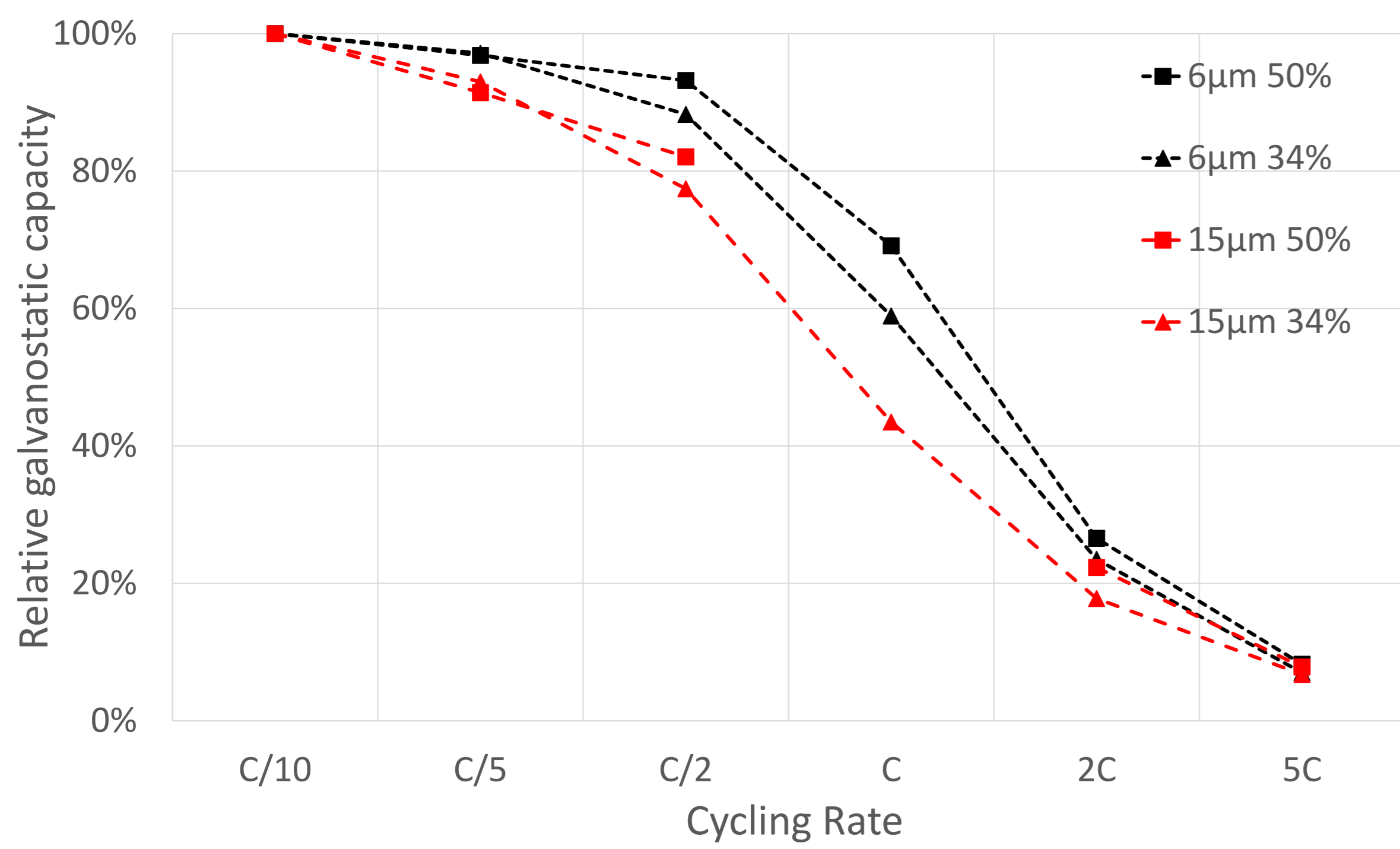


Every system has its limitations ... **kinetic limitations** are the one limiting Li-ion batteries, especially the graphite electrode !

Which transport processes are limiting the system ?

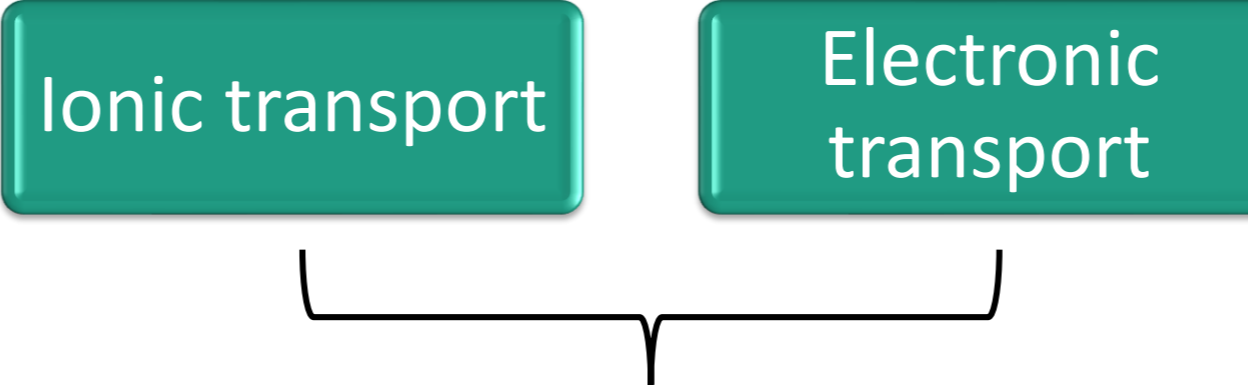


In-lab insight of kinetic limitations

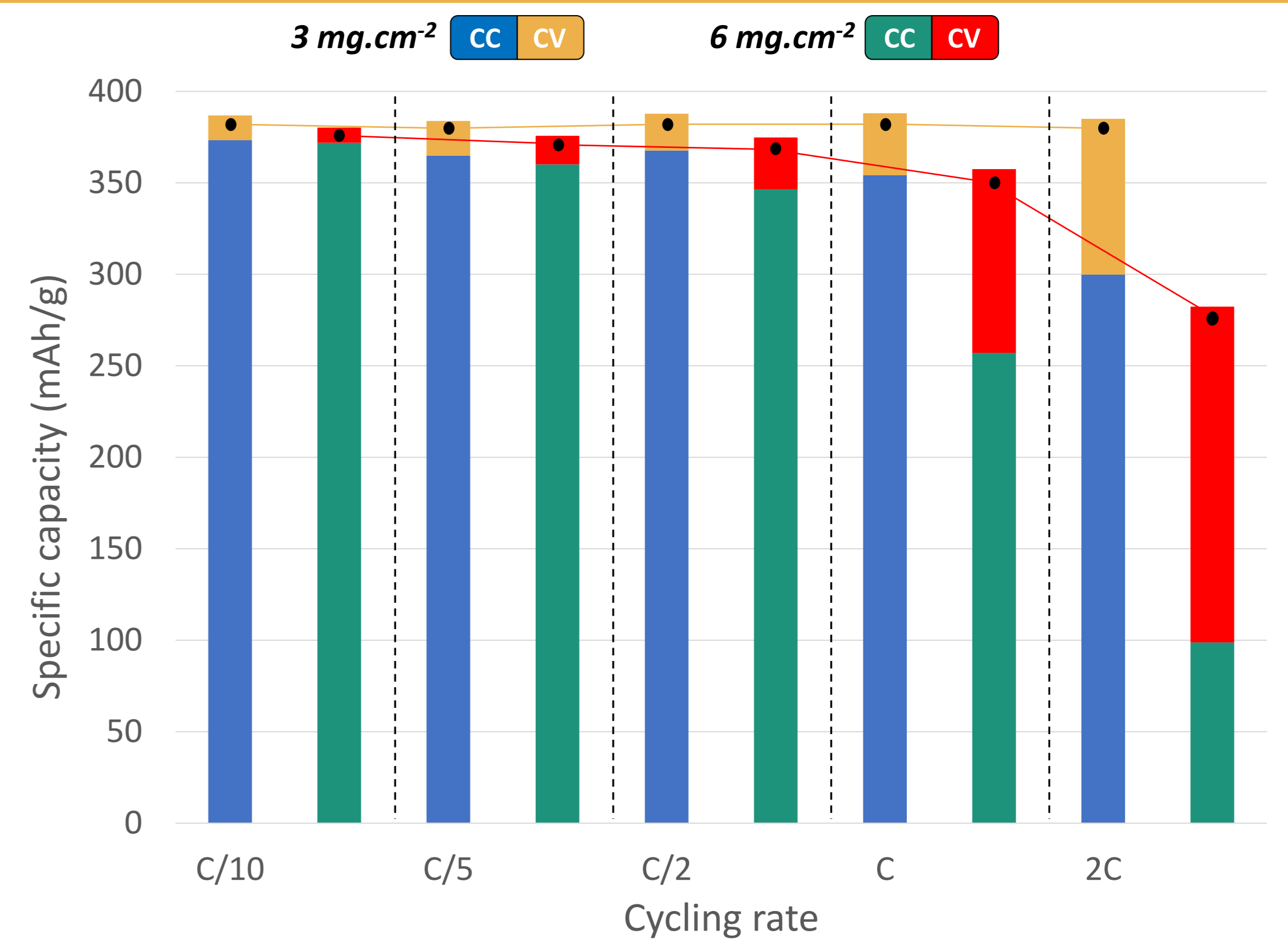


CC - CV cycling

- 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**



Which one is limiting ?



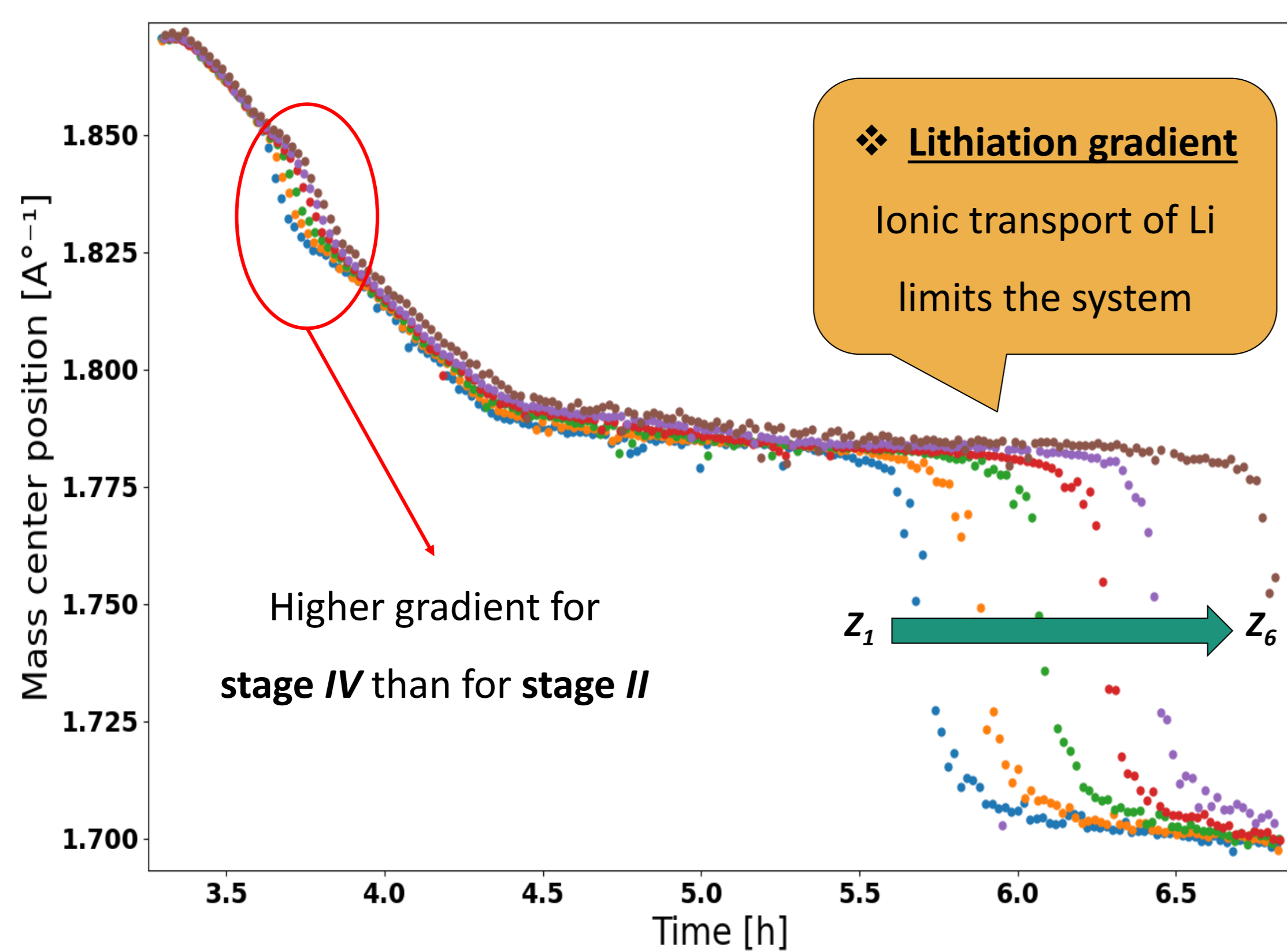
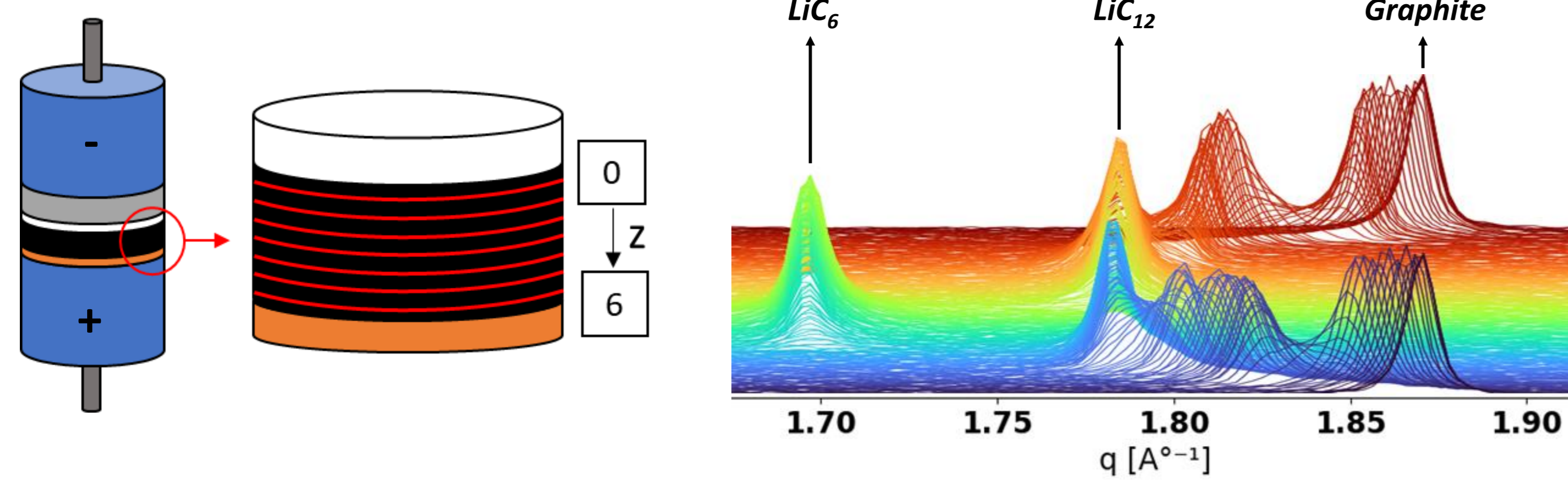
❖ Decreasing the porosity complexifies **electronic** and **ionic transport**

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

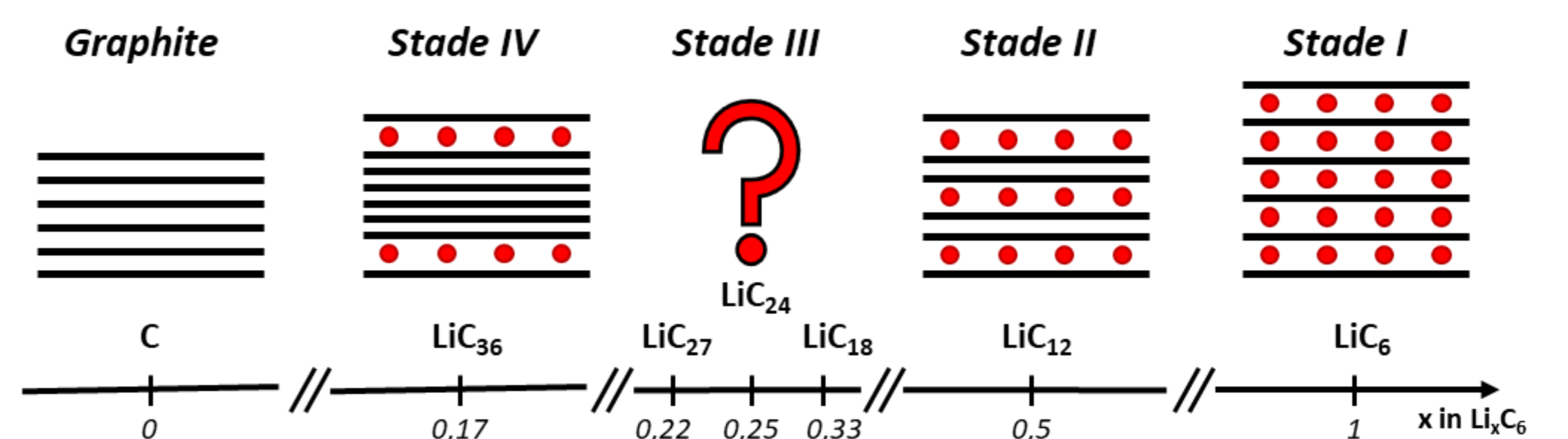
Synchrotron insight of kinetic limitations

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**



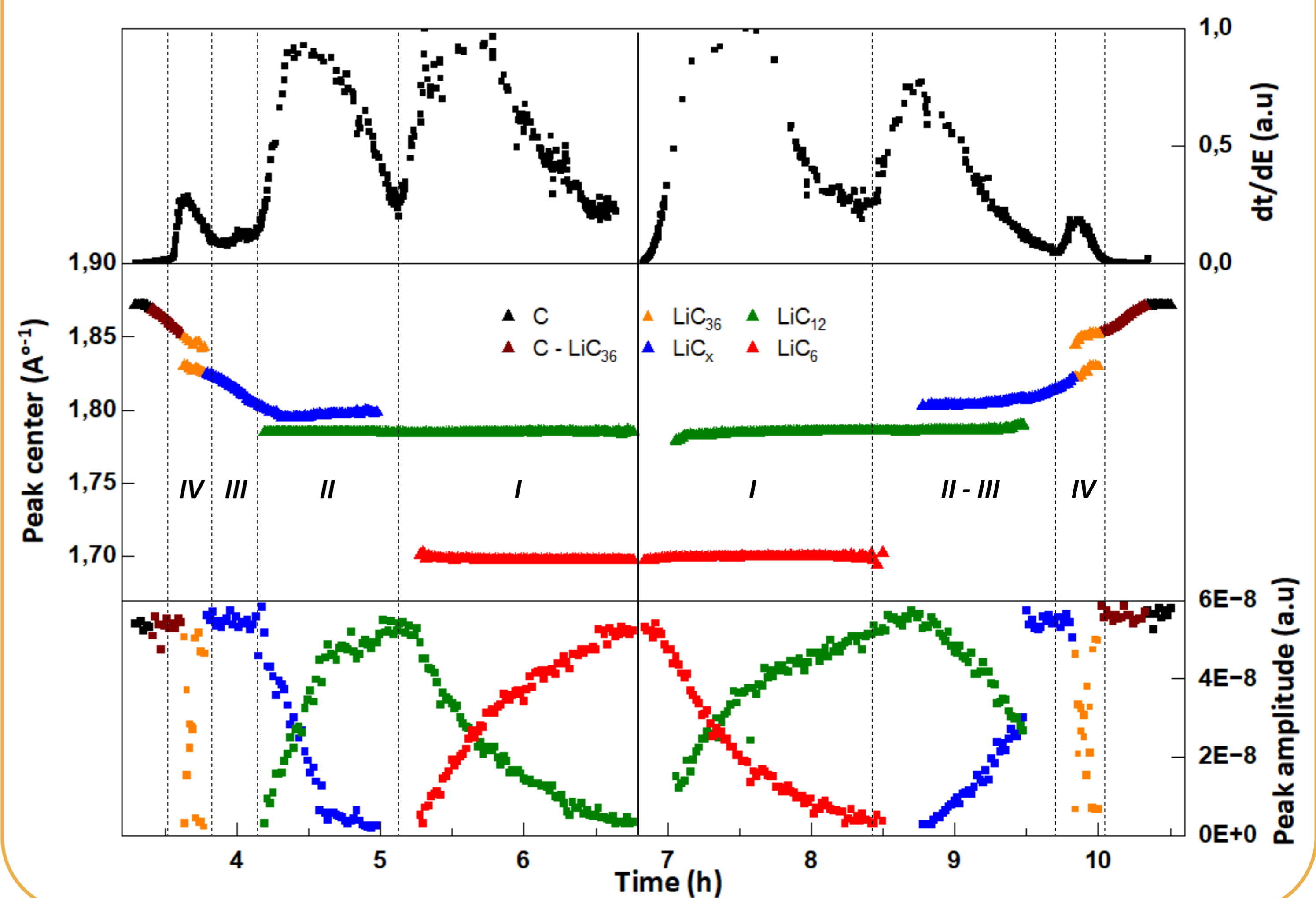
Additional characterization



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** ?