

PEO-grafted TiO₂ filler as Solid Polymer Electrolyte for rechargeable lithium batteries

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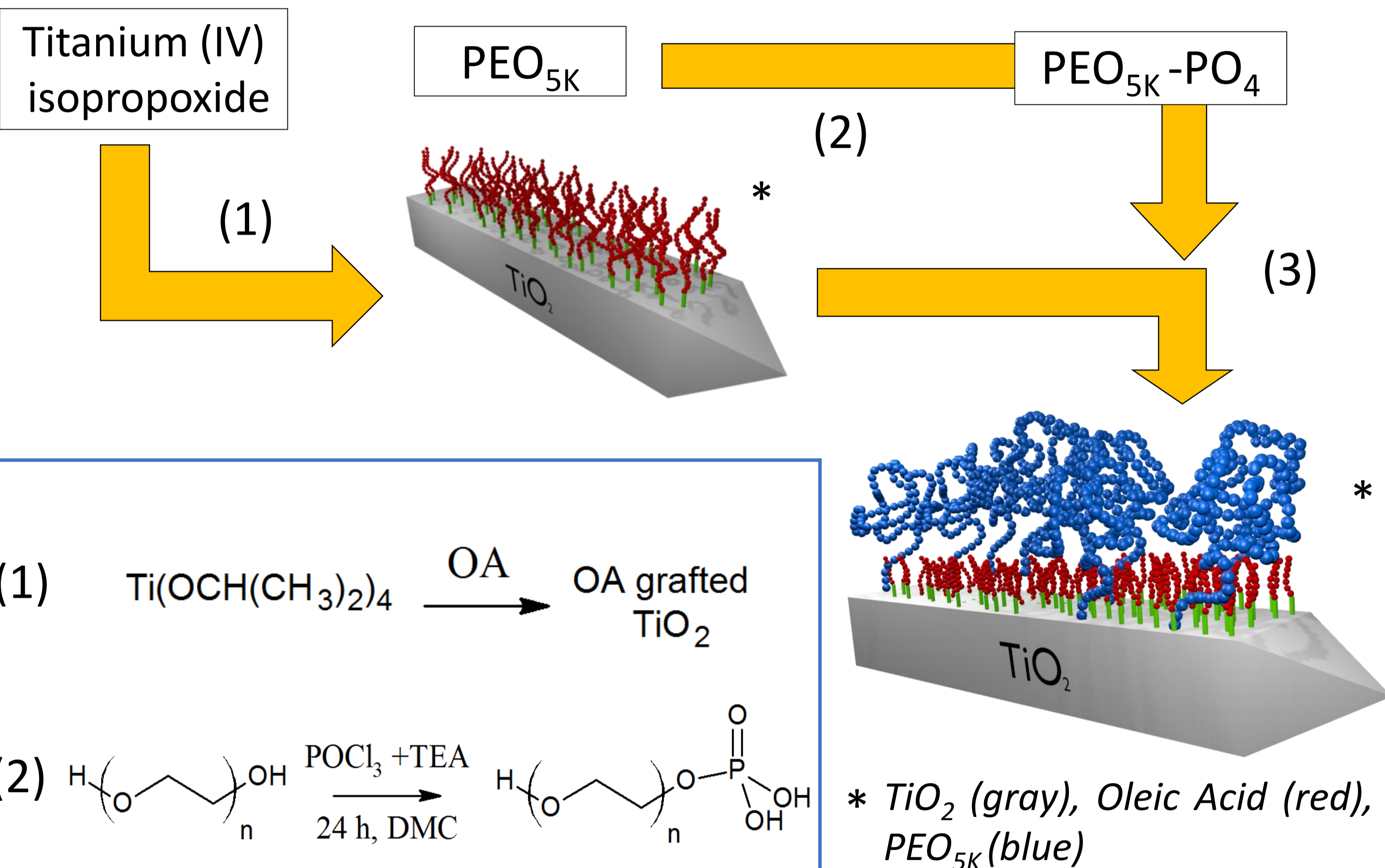
INTRODUCTION

The formation of lithium dendrites represents one of the main issues in the use of lithium anode for rechargeable batteries. To block their growth a possible solution is to increase the Young's modulus of the electrolytes by creating hybrid ceramic-polymer systems [1]. Our approach is the realization of small polymer-chain-grafted nanoparticles (NP) as a branched structure filler which gives a better chemistry affinity with the polymer matrix and increases its mechanical resistance [2]. In particular, here we investigate PEO_{5K}-grafted TiO₂ NP as a filler for PEO_{4M}/LiTFSI-based Solid Polymer Electrolyte.

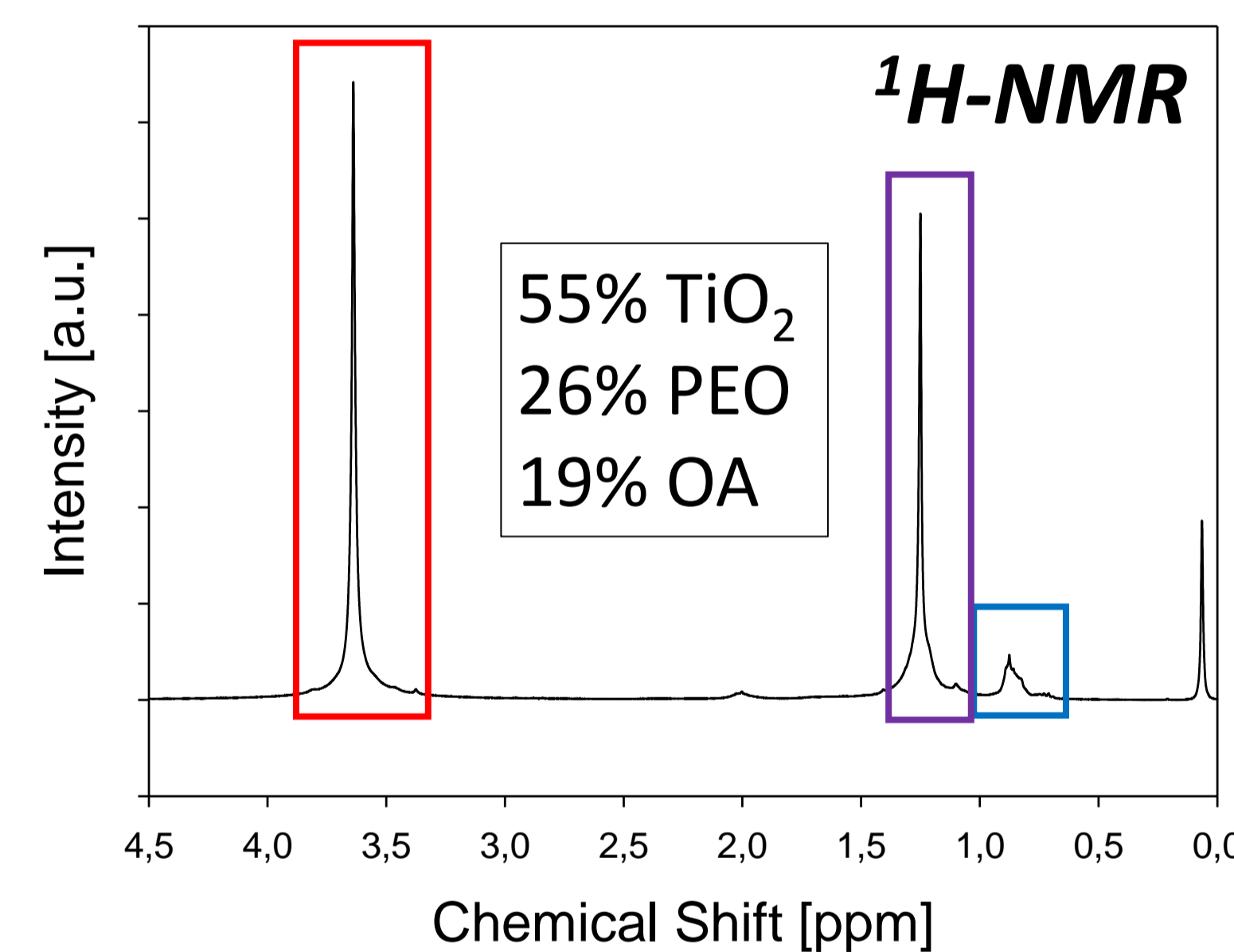
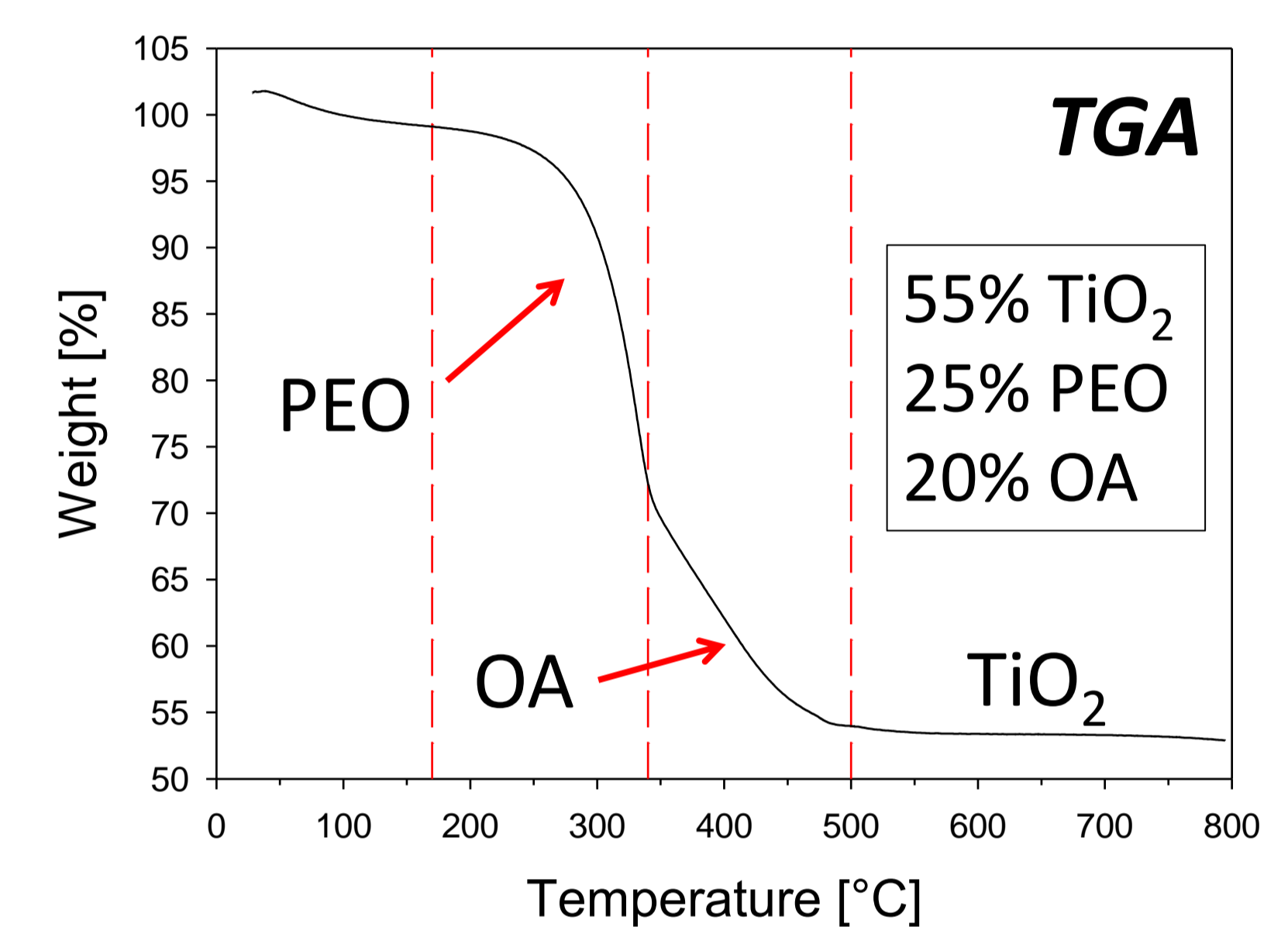
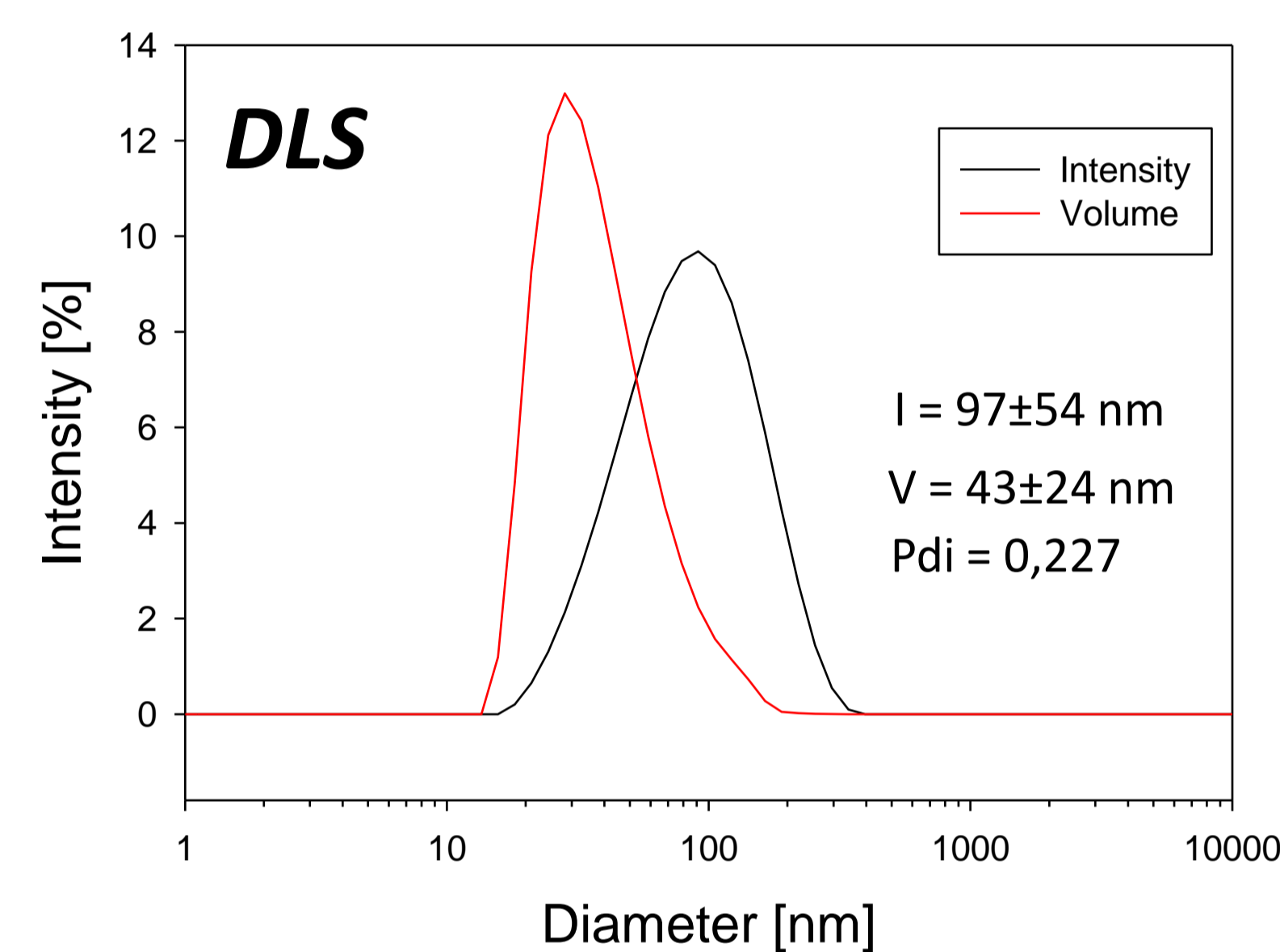
PEO-GRAFTED TiO₂ NANOPARTICLES (NP)

Synthesis steps [3]:

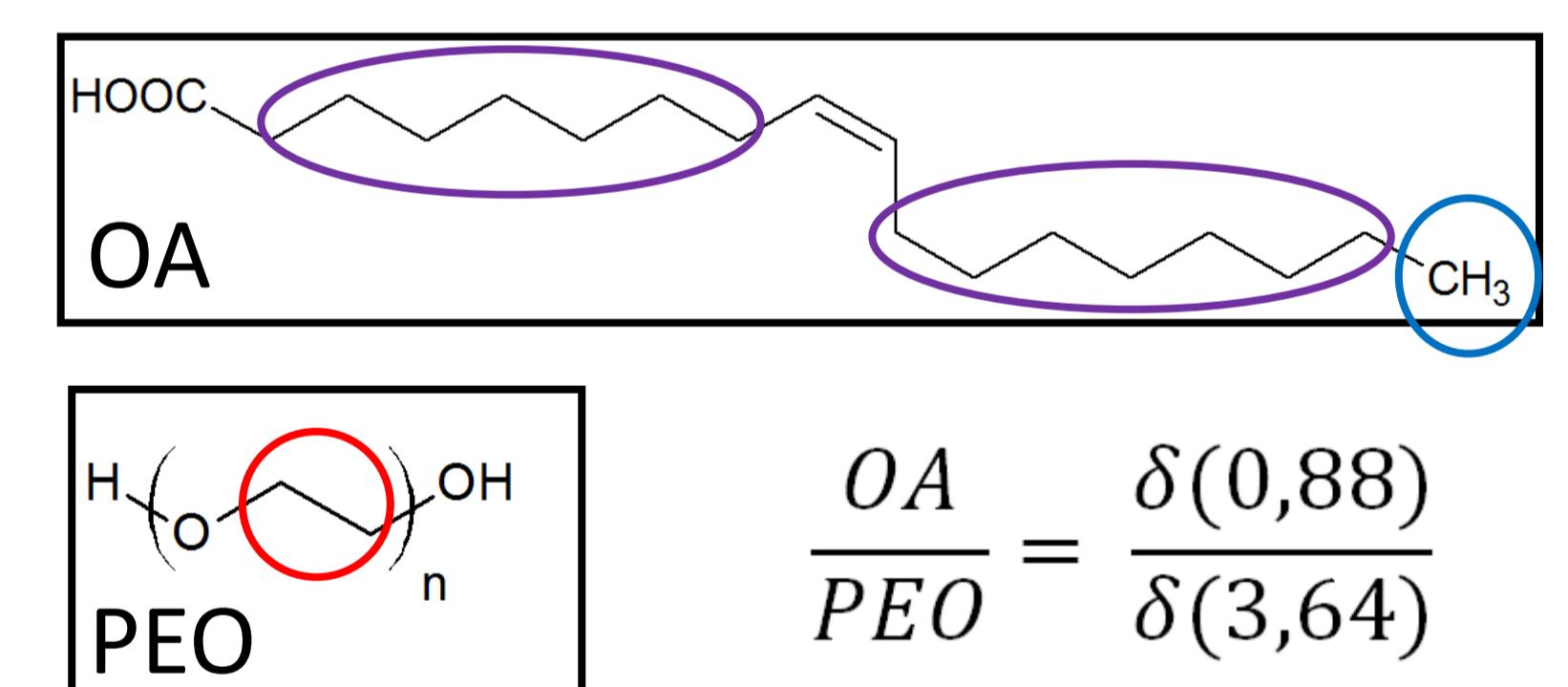
- (1) - Formation of oleic acid grafted TiO₂ NPs
- (2) - PEO end-group functionalization with phosphate group
- (3) - Ligand exchange oleic acid (OA) with PEO phosphate (PEO_{5K}-PO₄)



Characterizations:



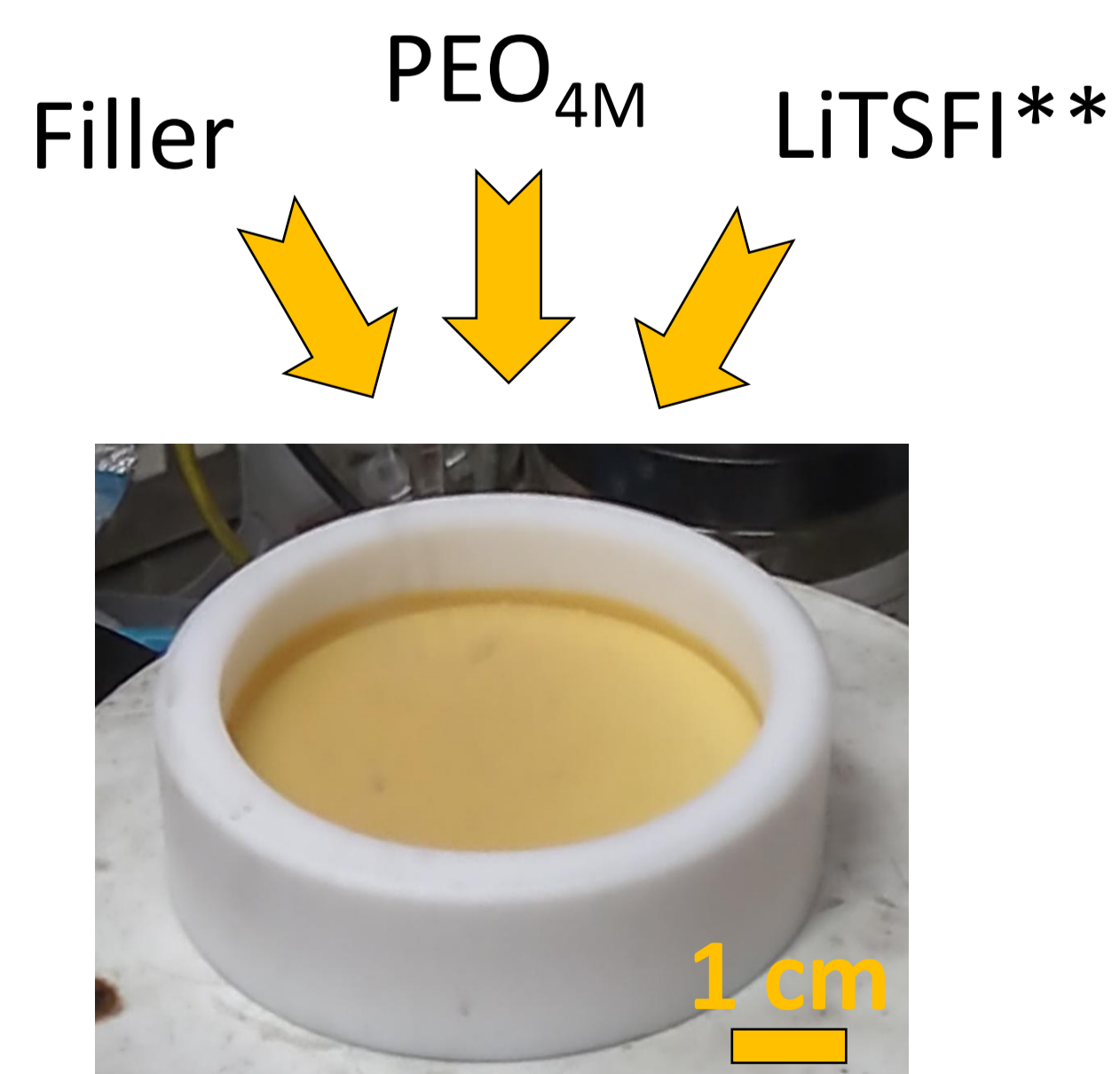
NPs size ≈ 97 nm,
NPs compositions from TGA and NMR



PEO_{5K} grafted TiO₂ - PEO_{6M} - LiTFSI membranes

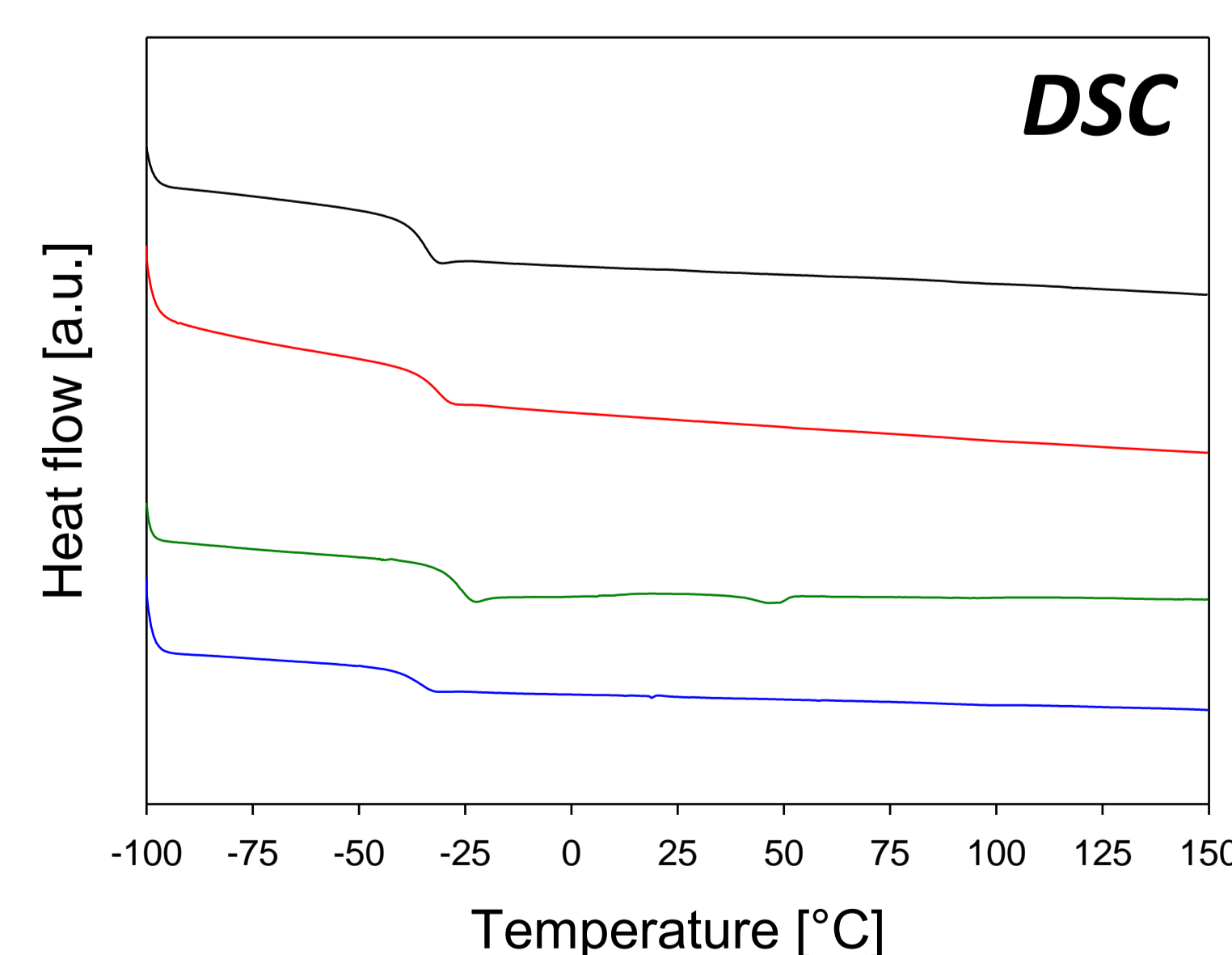
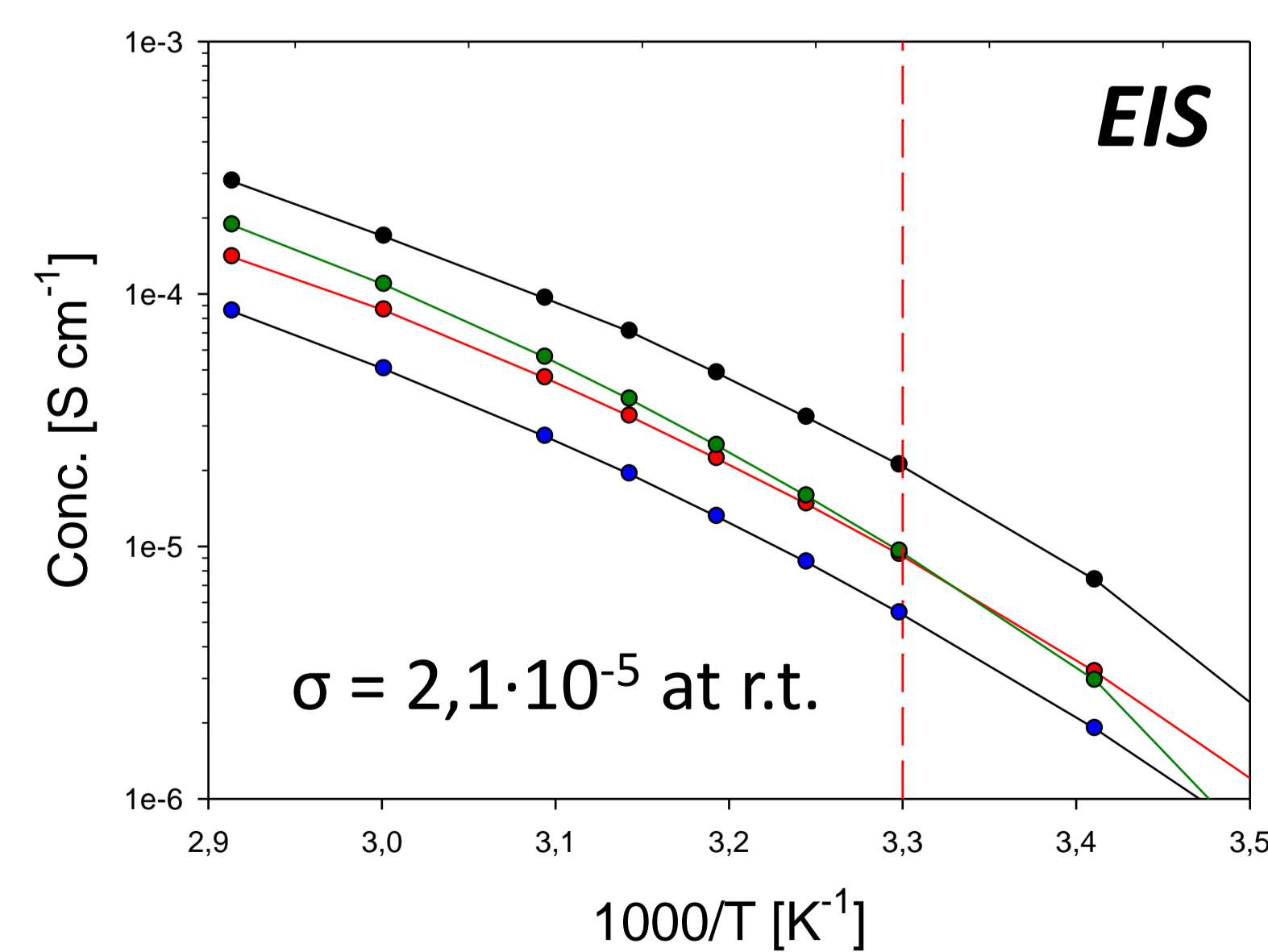
Preparation:

Solvent casting method is used

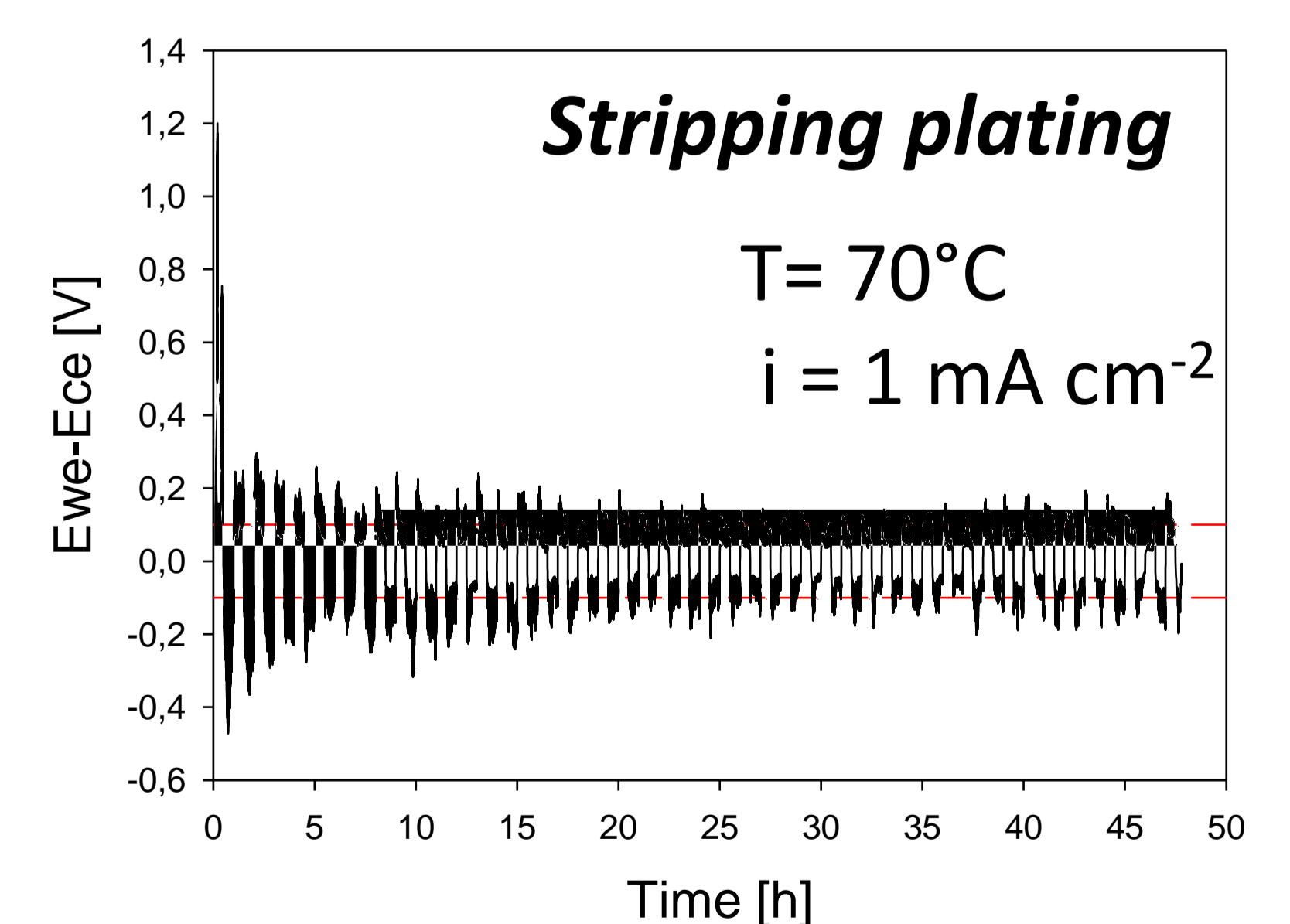


** Li/O ratio is calculated for total PEO

Characterizations:



- NP/PEO 50/50 with LiTFSI 1:10
- NP/PEO 70/30 with LiTFSI 1:10
- NP/PEO 70/30 with LiTFSI 1:6
- NP/PEO 90/10 with LiTFSI 1:10



[1] Karuppasamy K*, Antony R, Alwin S, Balakumar S, Sahaya Shajan X, Materials Science Forum Vol.807(2015):41-63

[3] Cozzoli PD et al., JAm Chem Soc. 2003 Nov 26;125(47):14539-48

[2] Soujanya Gowdani, Kota Ramanjaneyulu, and Pratyay Basak, ACS nano Vol.8(2014).

[4] G. B. Appetecchi, et al.; J. Electrochem. Soc. Vol. 145(1998)