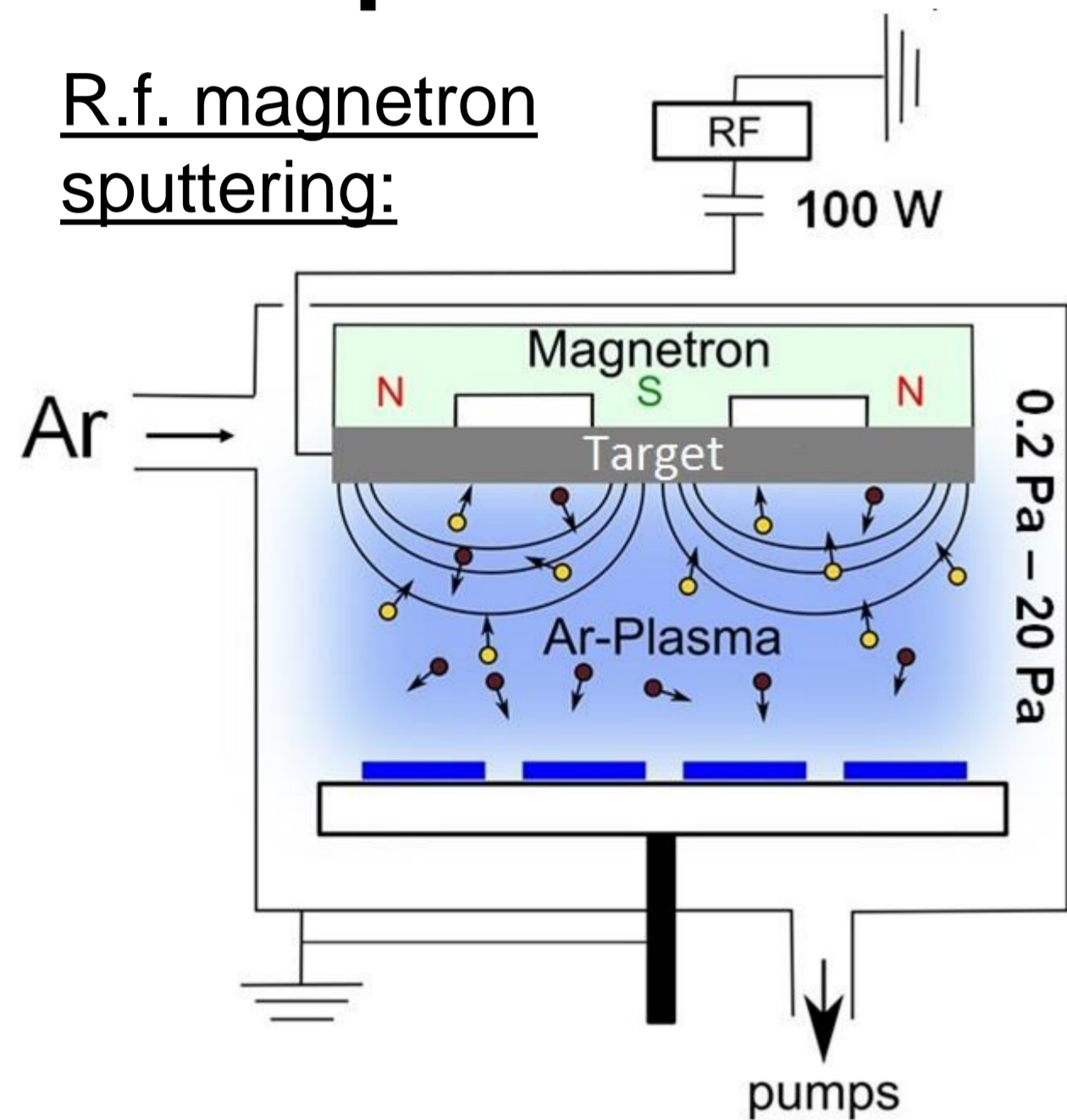


Influence of the substrate topography on the constitution of Li-rich Li-Ni-Mn-Co-O thin film for battery application

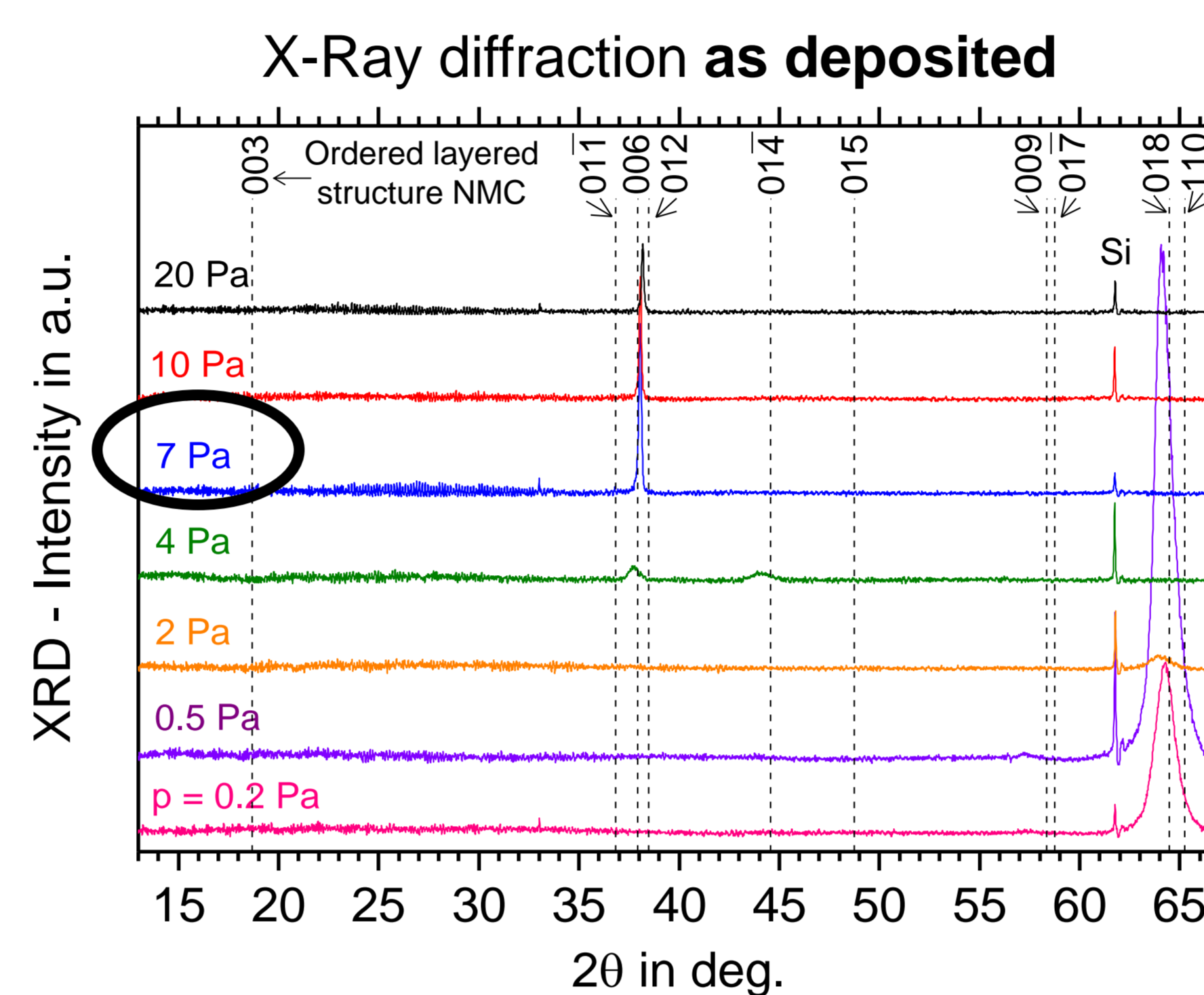
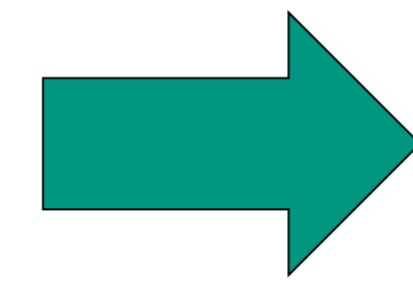
M. Strafela, K. Seemann, H. Leiste, H.J. Seifert, S. Ulrich

By increasing the surface area is it possible to improve the Li-diffusion rate or rate capability of Lithium-Ion batteries. The surface topography of stainless steel substrates are varied by sputter etching. Stainless steel substrates were sputter etched for 12 minutes at 500 W and between 30 minutes to 180 minutes at 900 W. Li-rich Li-Ni-Mn-Co-O thin films are deposited onto these modified stainless steel substrates by non-reactive r.f. magnetron sputtering from a ceramic $\text{Li}_{1.11}(\text{Ni}_{0.37}\text{Mn}_{0.19}\text{Co}_{0.33})\text{O}_{1.77}$ target. Coating thickness is about 100 nm. In order to induce a transition of the crystalline films from a disordered to an ordered layered structure the films were post heat treated at 600 °C for one hour at 10 mPa in Argon:Oxygen (80:20).

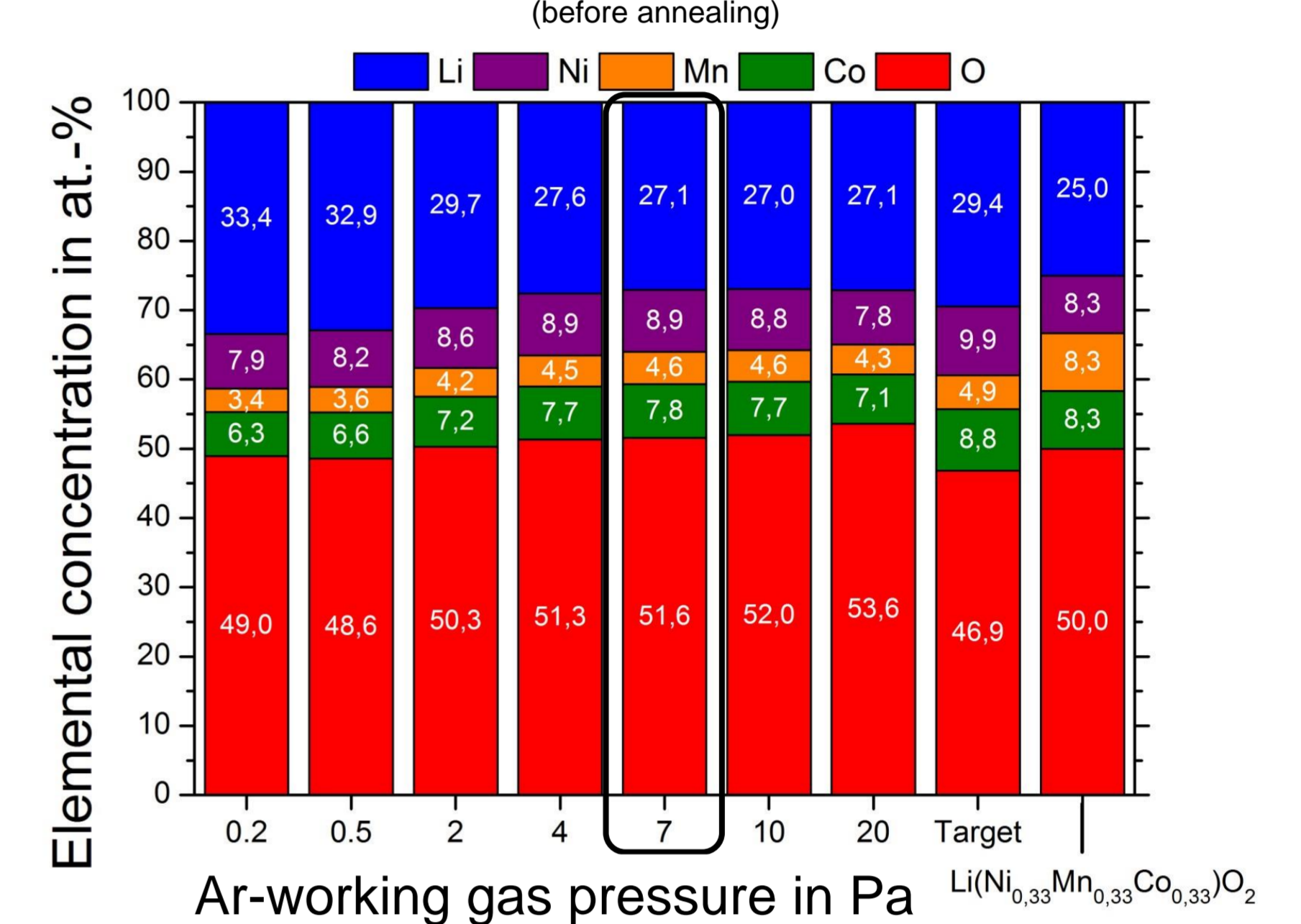
Film deposition



Pressure variation

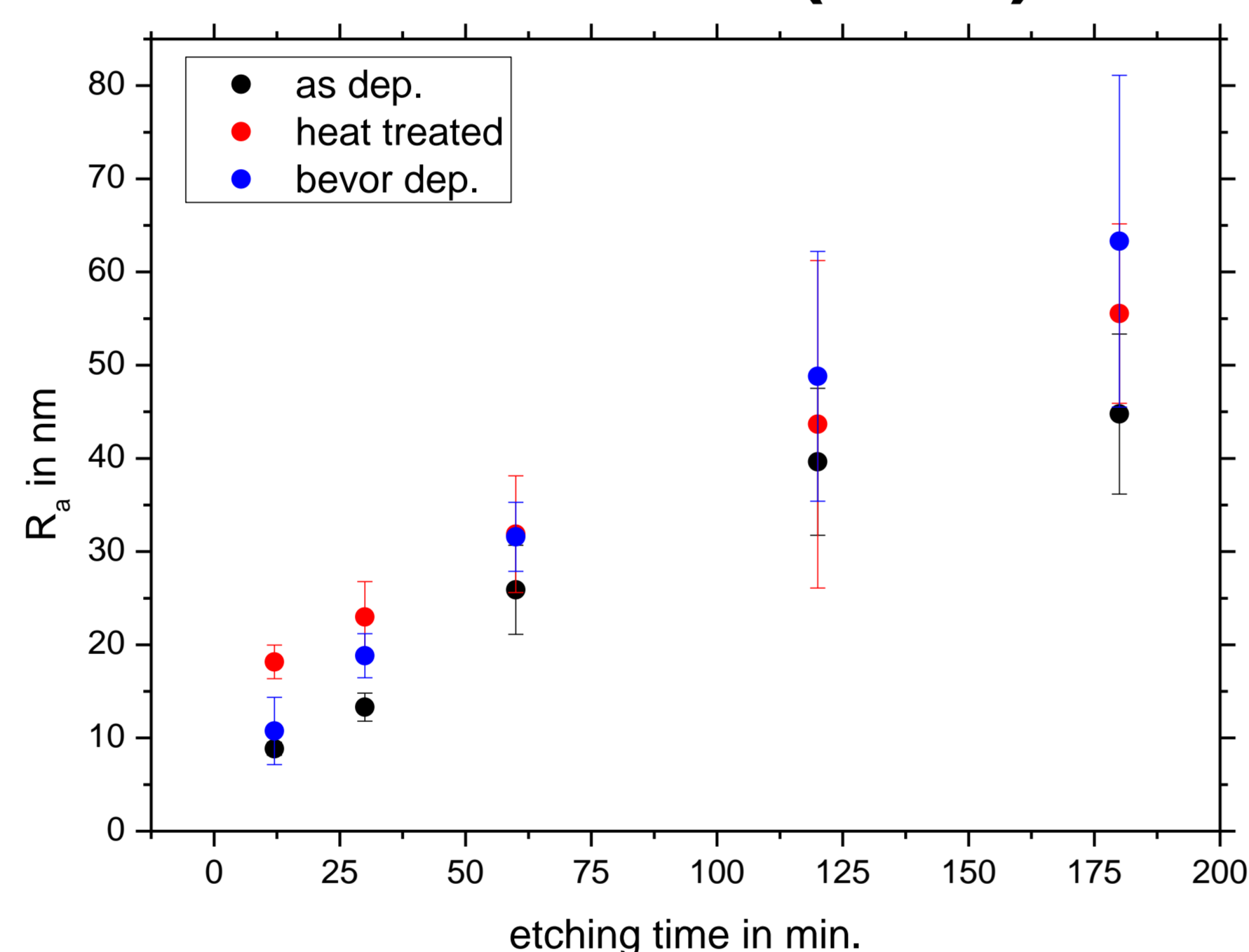


ICP-OES and CGHE analysis



Film roughness of selected films (7 Pa)

Film roughness (R_A , 20 μm x 20 μm) of as deposited and heat treated films depending on the pre-deposition etching time. Before deposition the substrates were sputter etched for 12 min with 500 W and between 30 min to 180 min with 900 W.

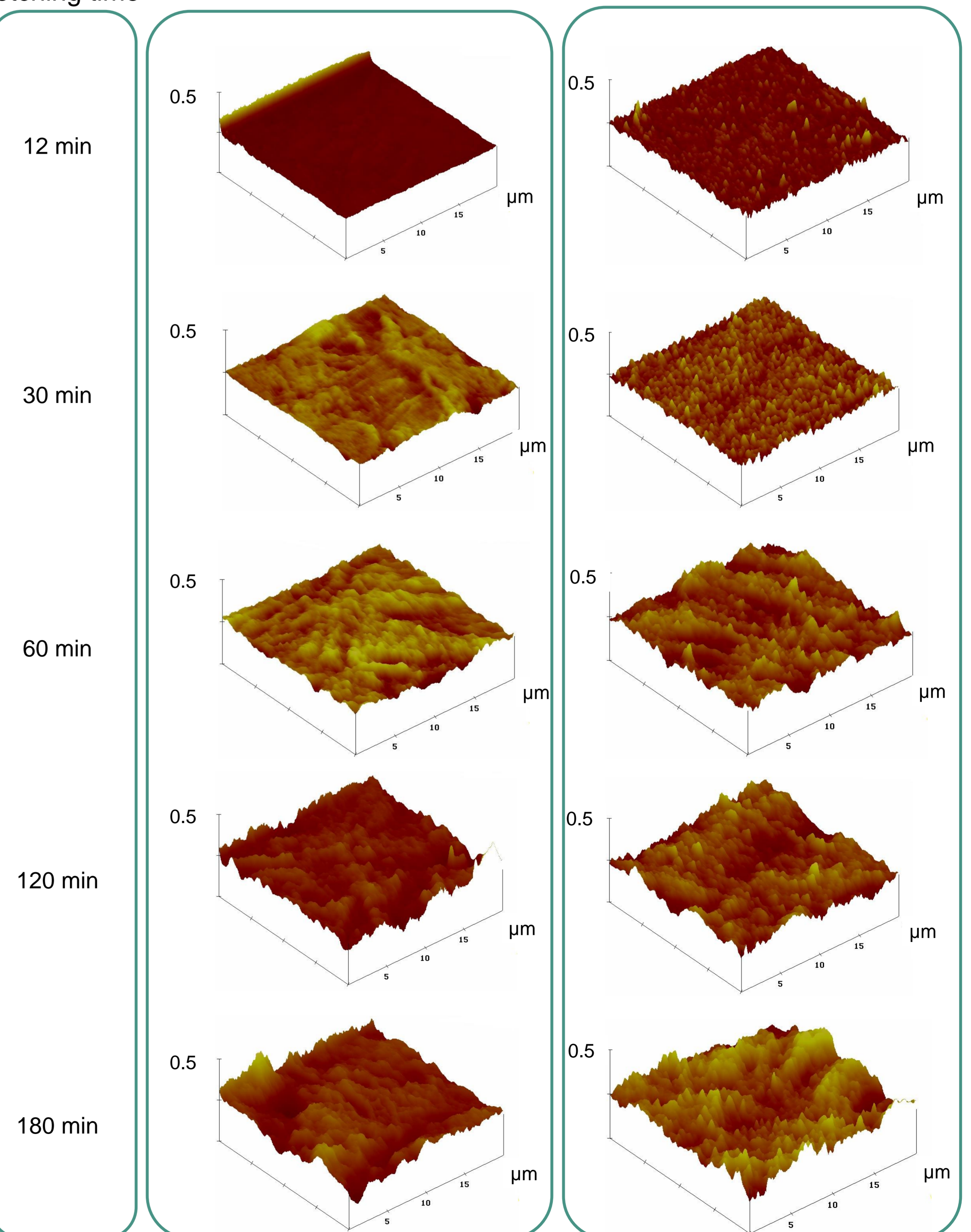


AFM measurements

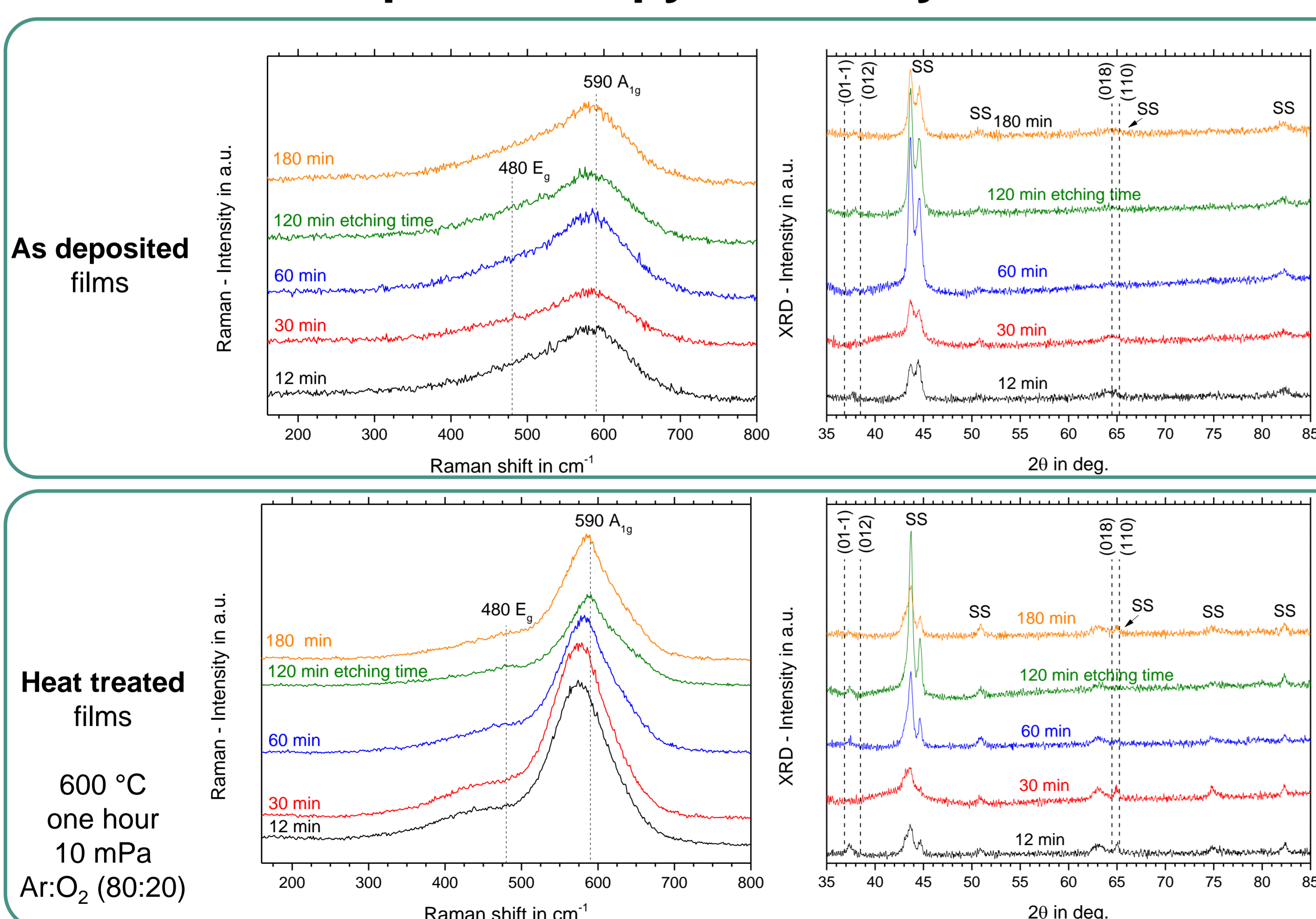
Pre-deposition etching time

As deposited films

Heat treated films
600 °C
one hour
10 mPa
Ar:O₂ (80:20)



Raman-spectroscopy and X-ray diffraction



Conclusions and Outlook:

- Li-Ni-Mn-Co-O thin films were successfully deposited on stainless steel with different surface topography.
- By pre-deposition sputter etching the film roughness (R_A) can be adjusted between 8 nm to 44 nm.
- Film roughness has no significant influence on other microstructural.

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