

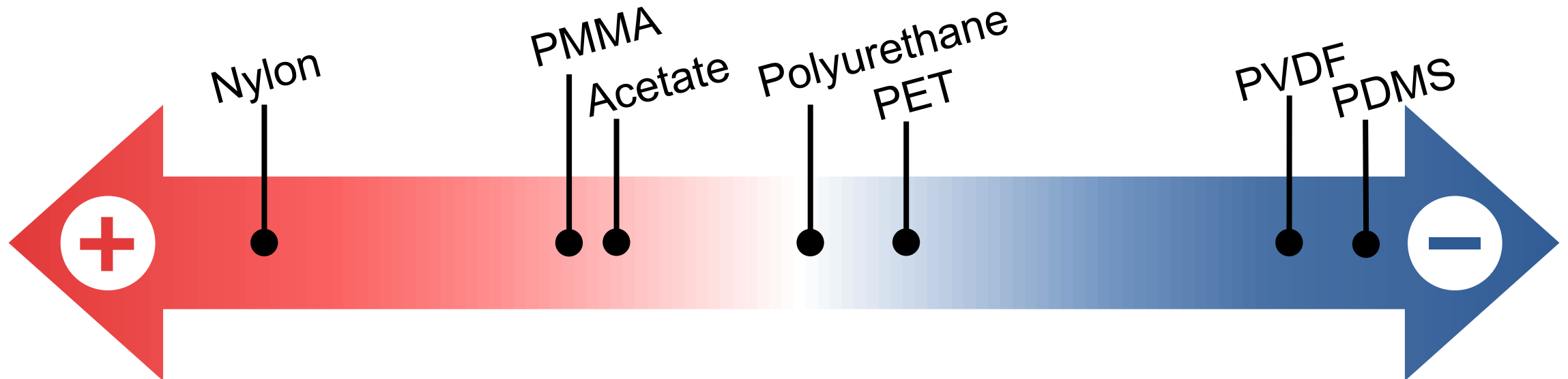


# Fiber-based triboelectric generators for smart textiles using surface-modified electrospun polymer fibres

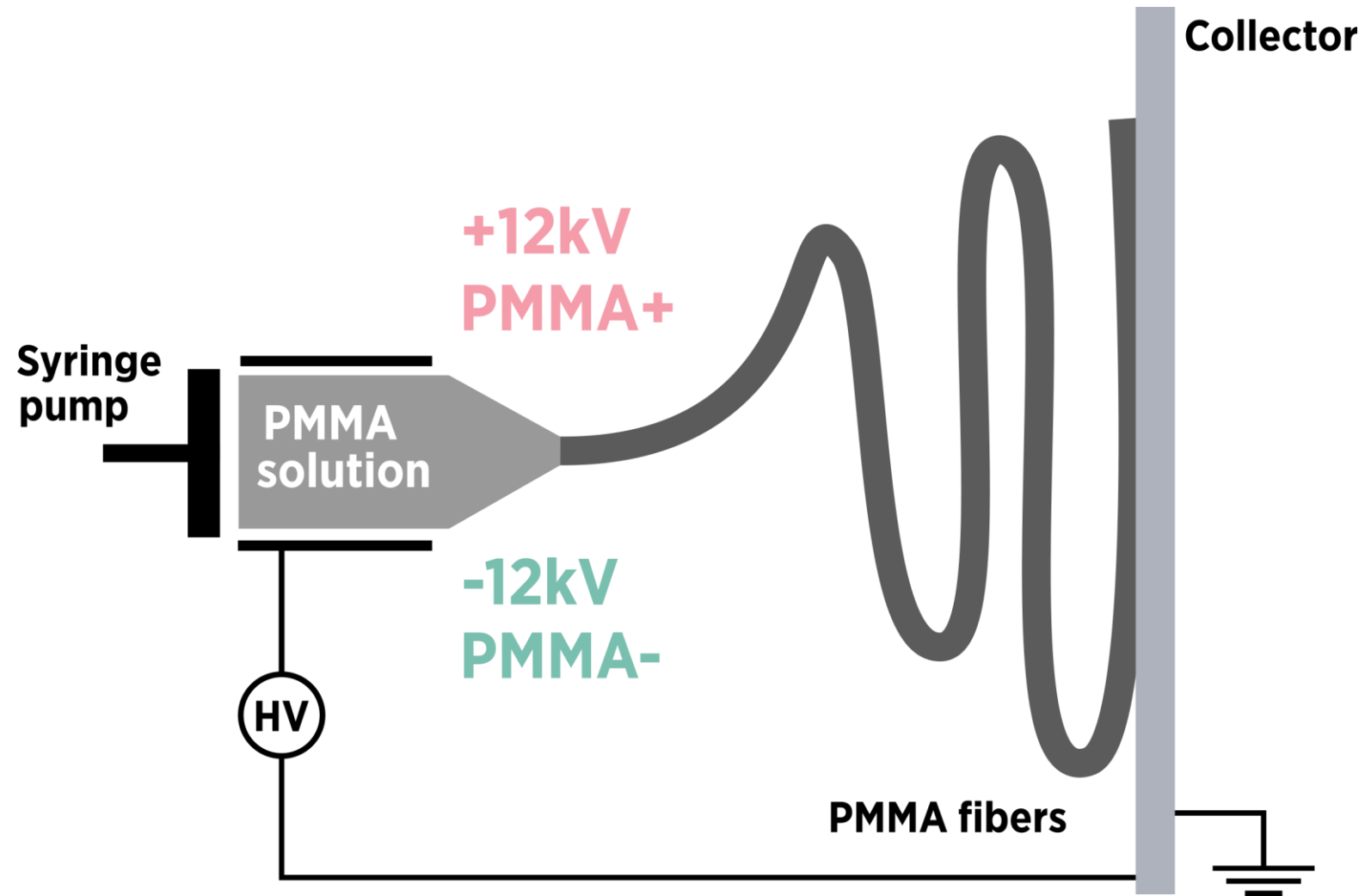
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# Triboelectric generator

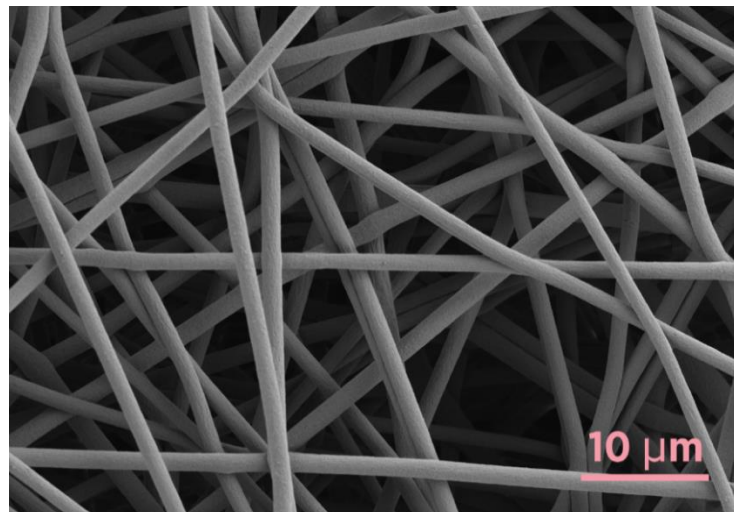


# Electrospinning PMMA

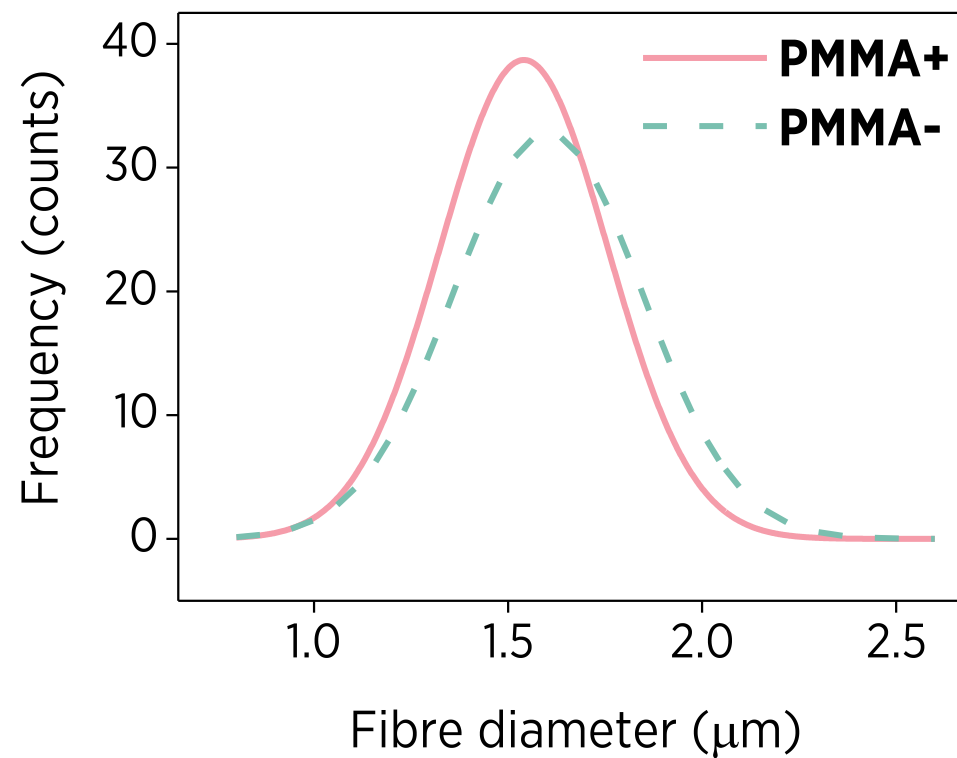
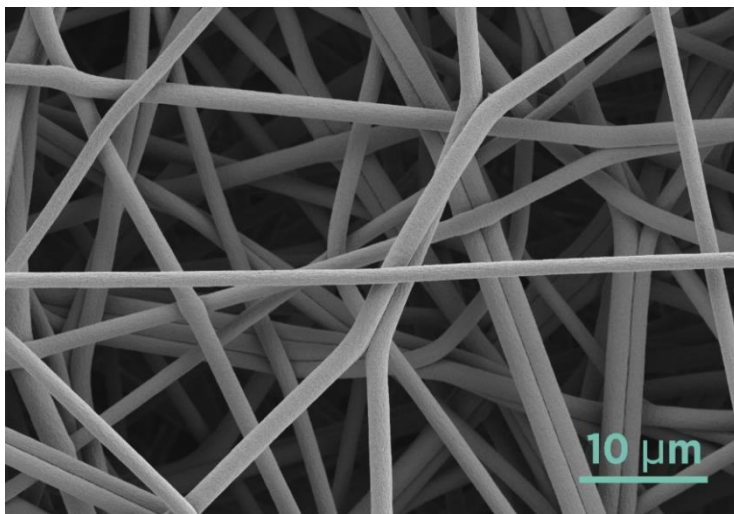


# PMMA+ and PMMA- fibers

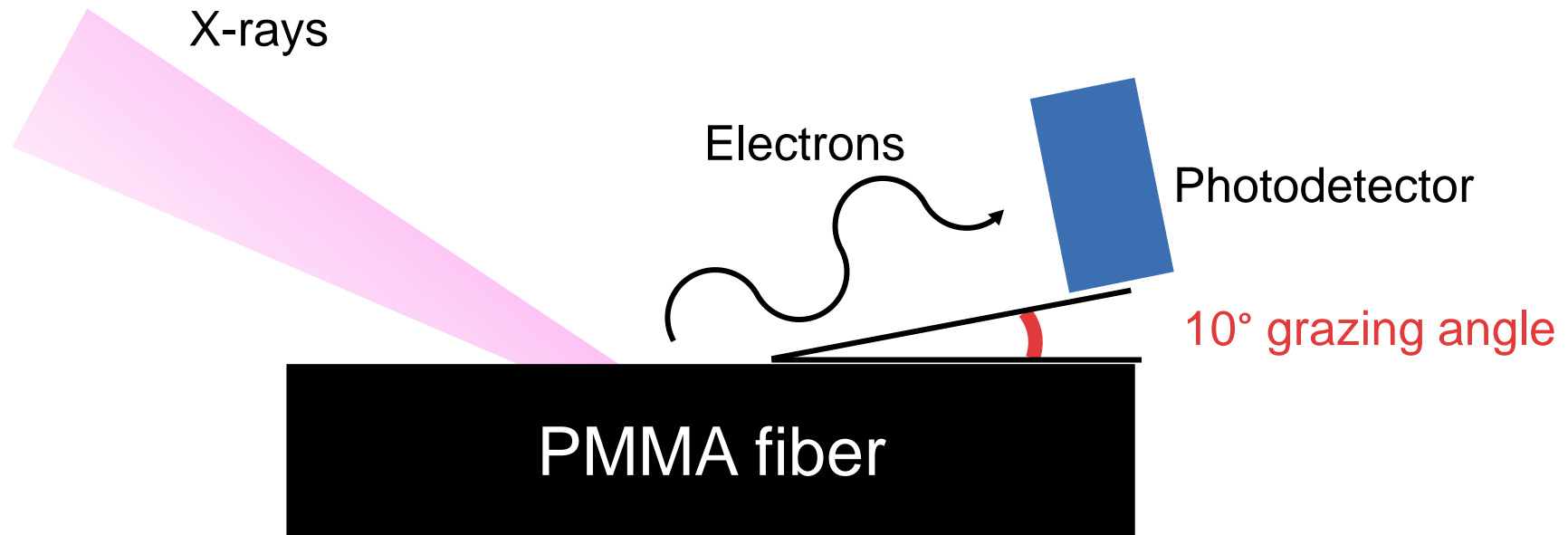
PMMA+



PMMA-

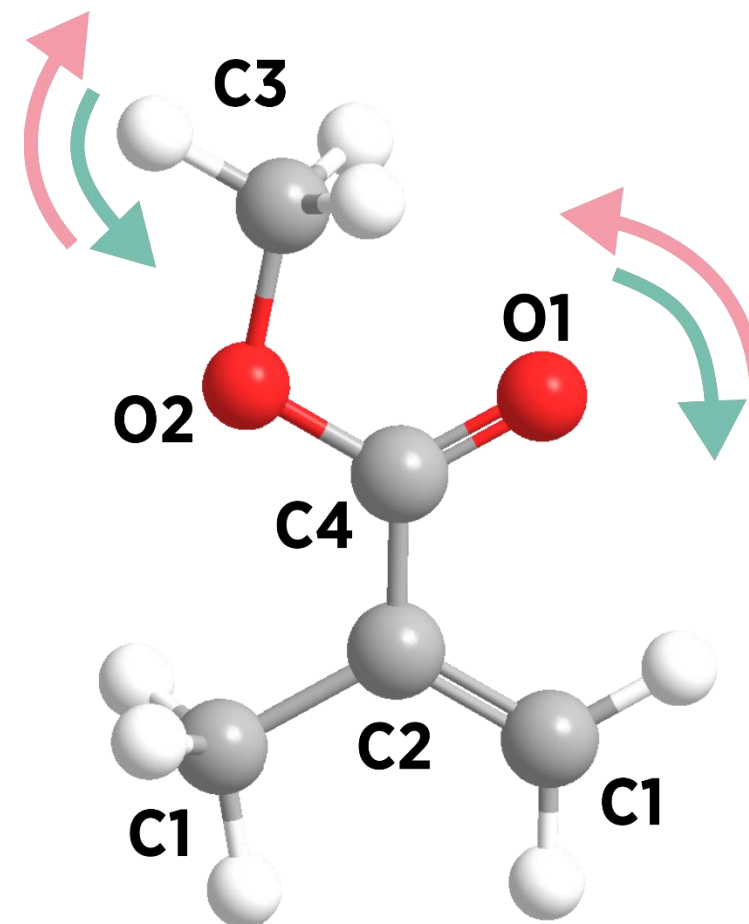


# X-ray photoelectron spectroscopy (XPS)



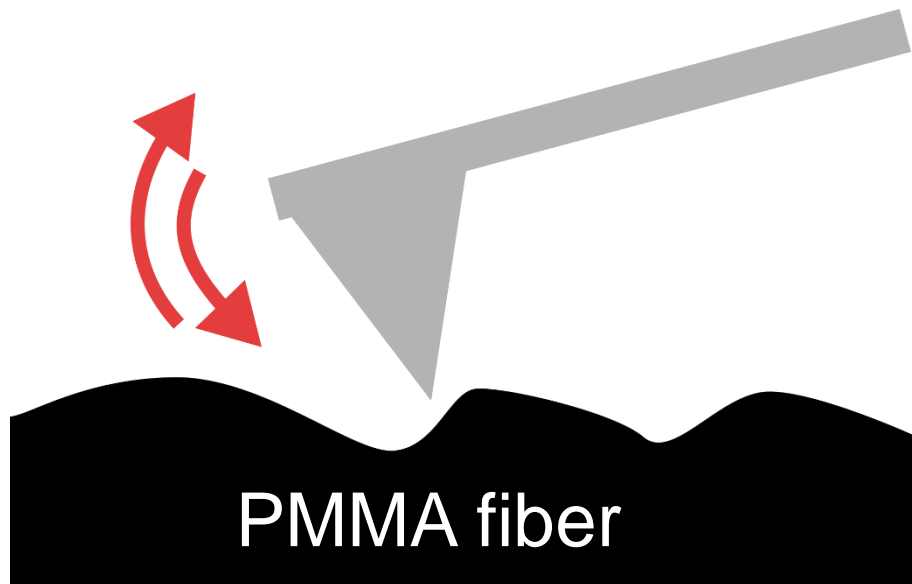
# Fibers surface chemistry - XPS

|       | C3 (%) | C4 (%) | O1 (%) | O2 (%) |
|-------|--------|--------|--------|--------|
| PMMA+ | 14.0   | 15.7   | 12.1   | 14.4   |
| PMMA- | 9.8    | 14.6   | 11.6   | 14.3   |

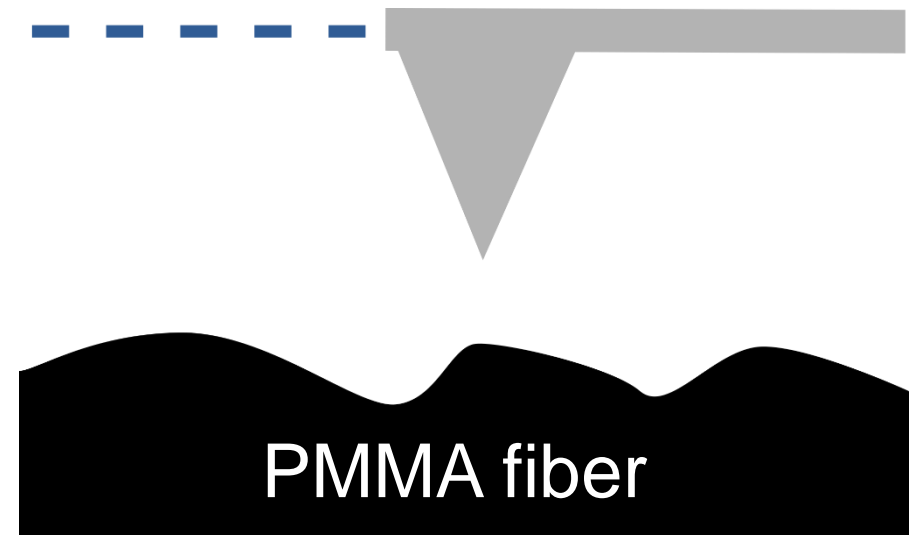


# Kelvin Probe Force Microscopy (KPFM)

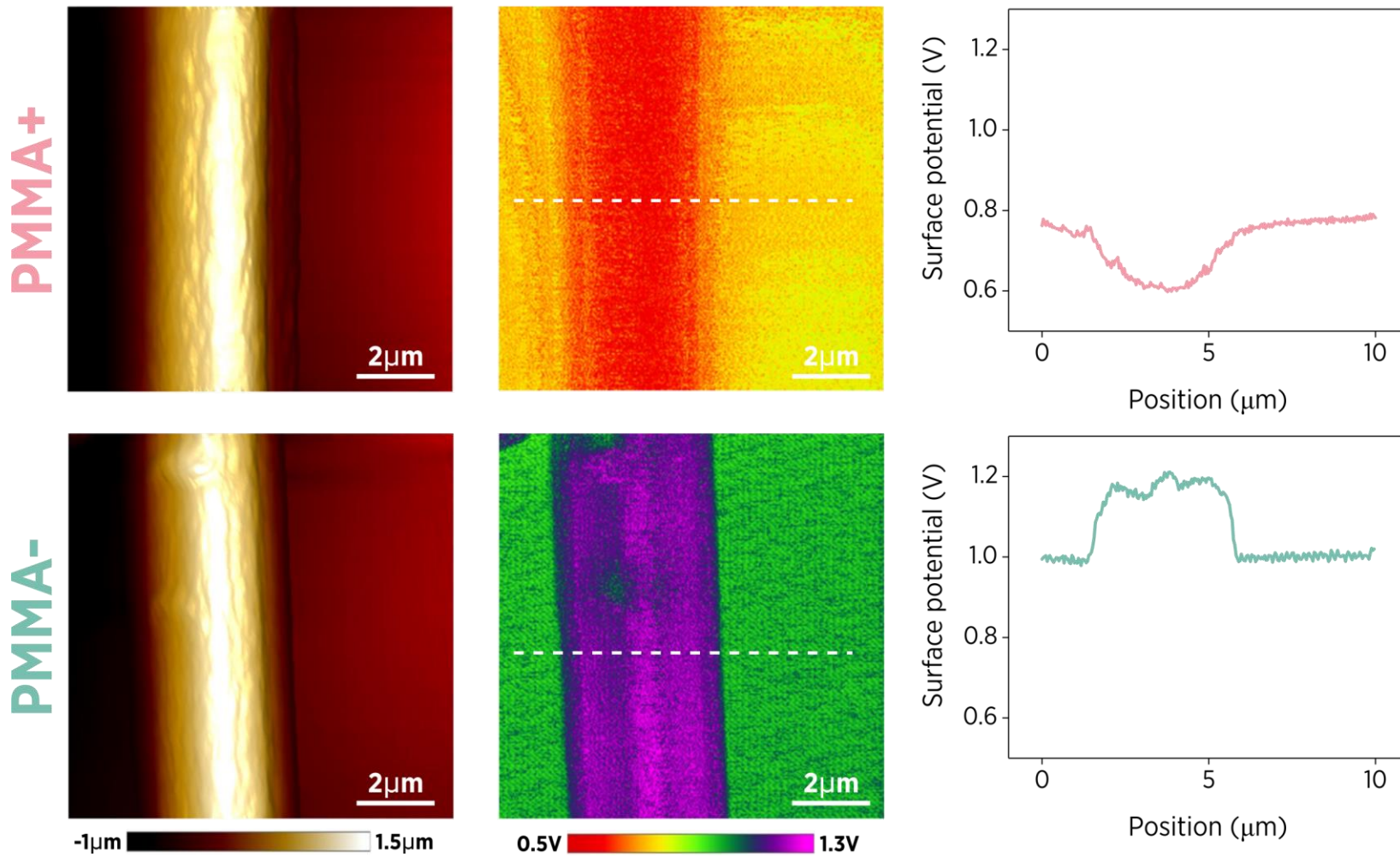
1<sup>st</sup> scan – Topography  
(Tapping AFM)



2<sup>nd</sup> scan – Surface potential  
(Lift scan)

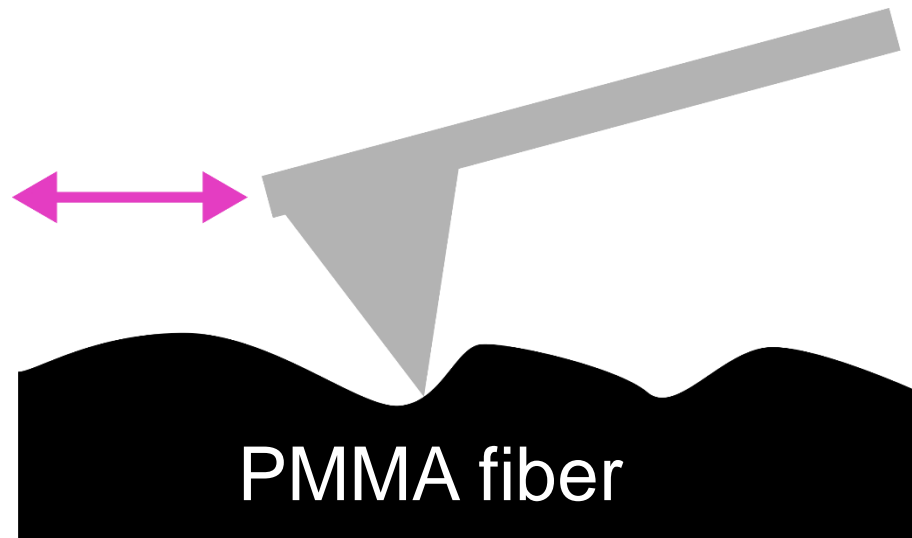


# Surface potential - KPFM

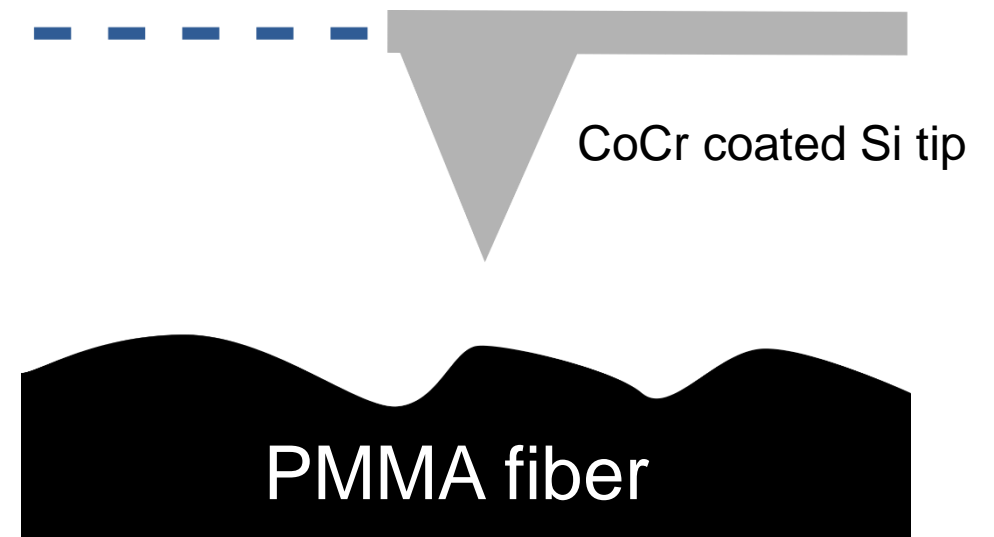


# Rubbing KPFM

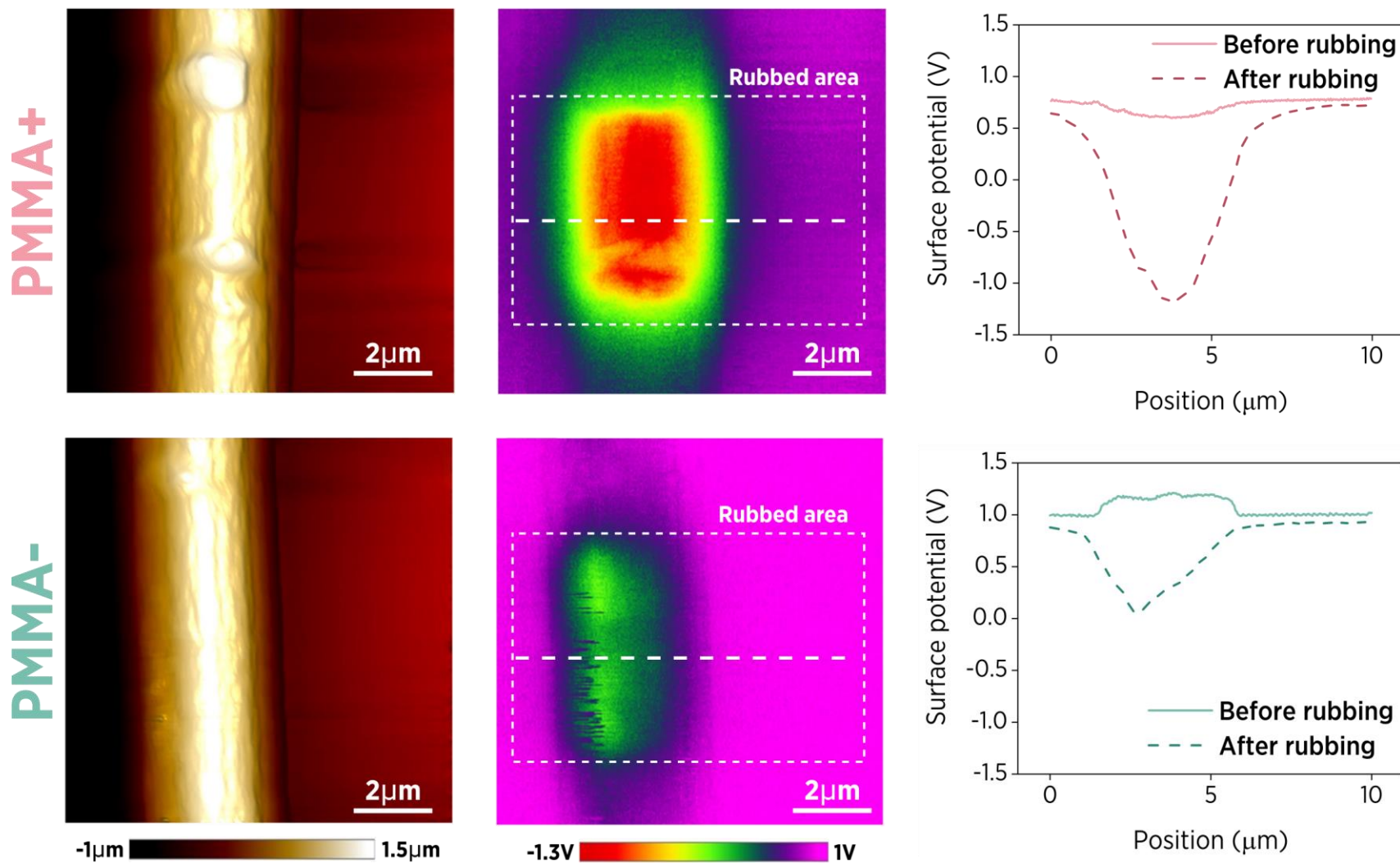
1<sup>st</sup> step – Rubbing  
(Contact AFM)



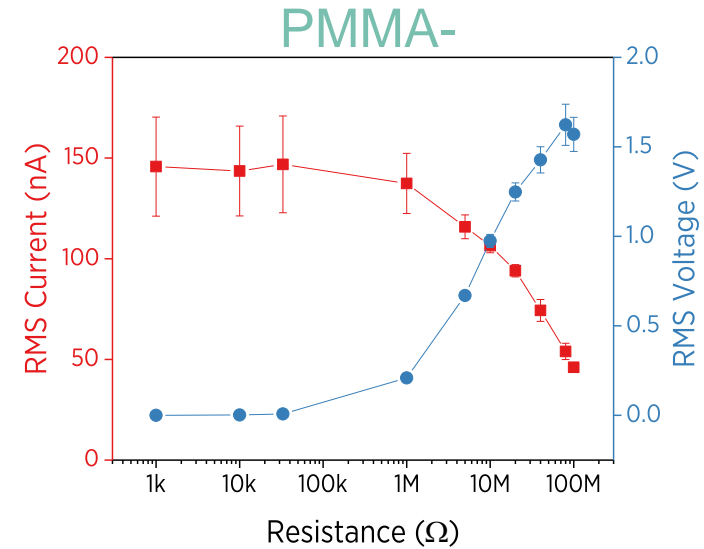
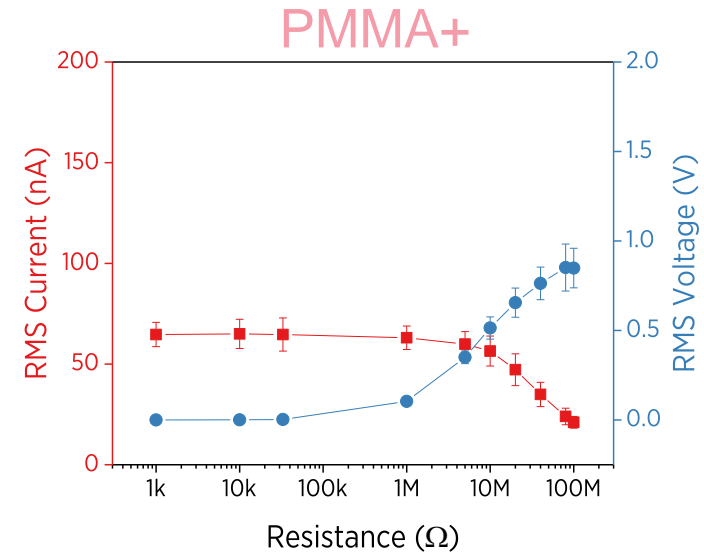
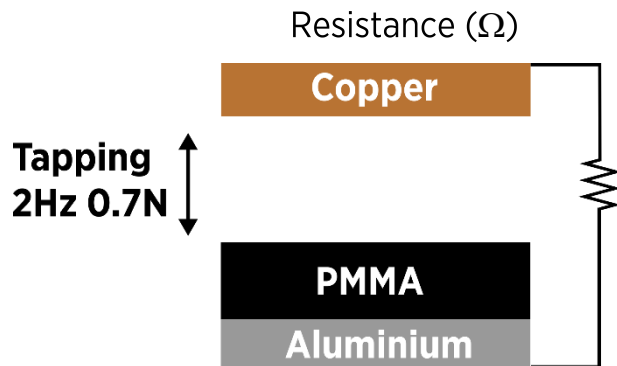
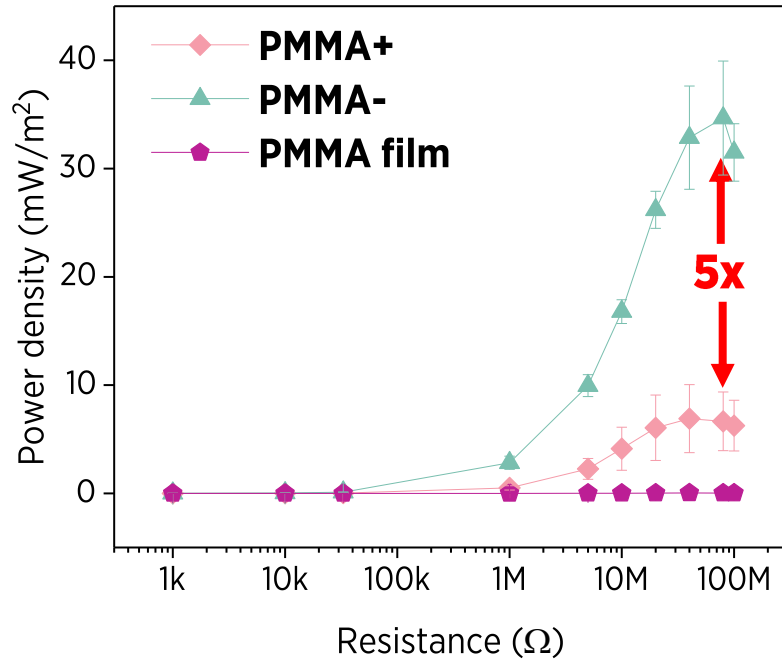
2<sup>nd</sup> step – Surface potential  
(KPFM)



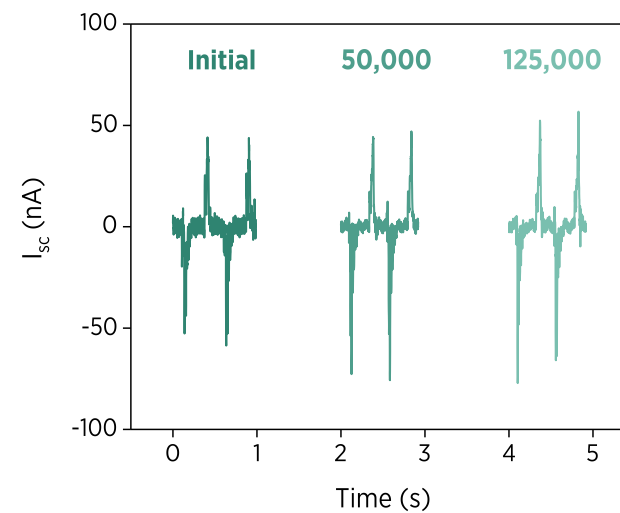
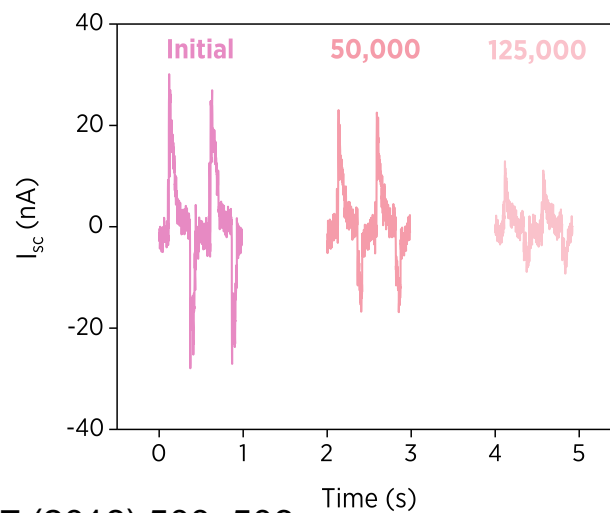
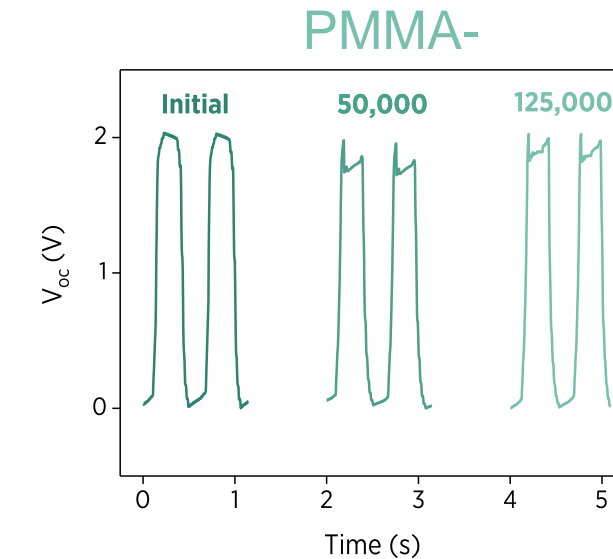
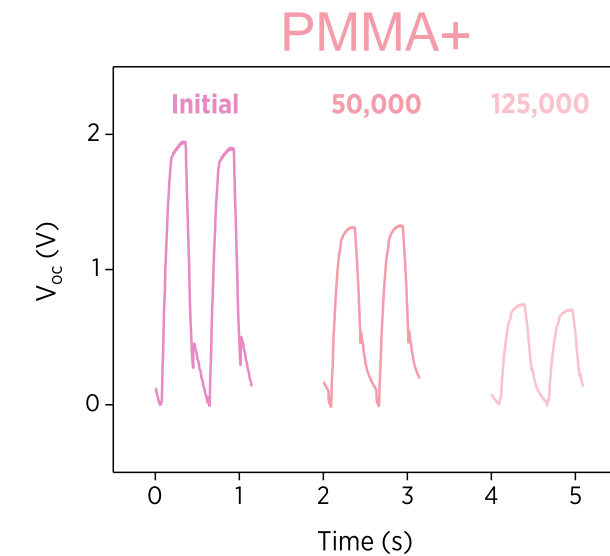
# Charge transfer affinity - Rubbing KPFM



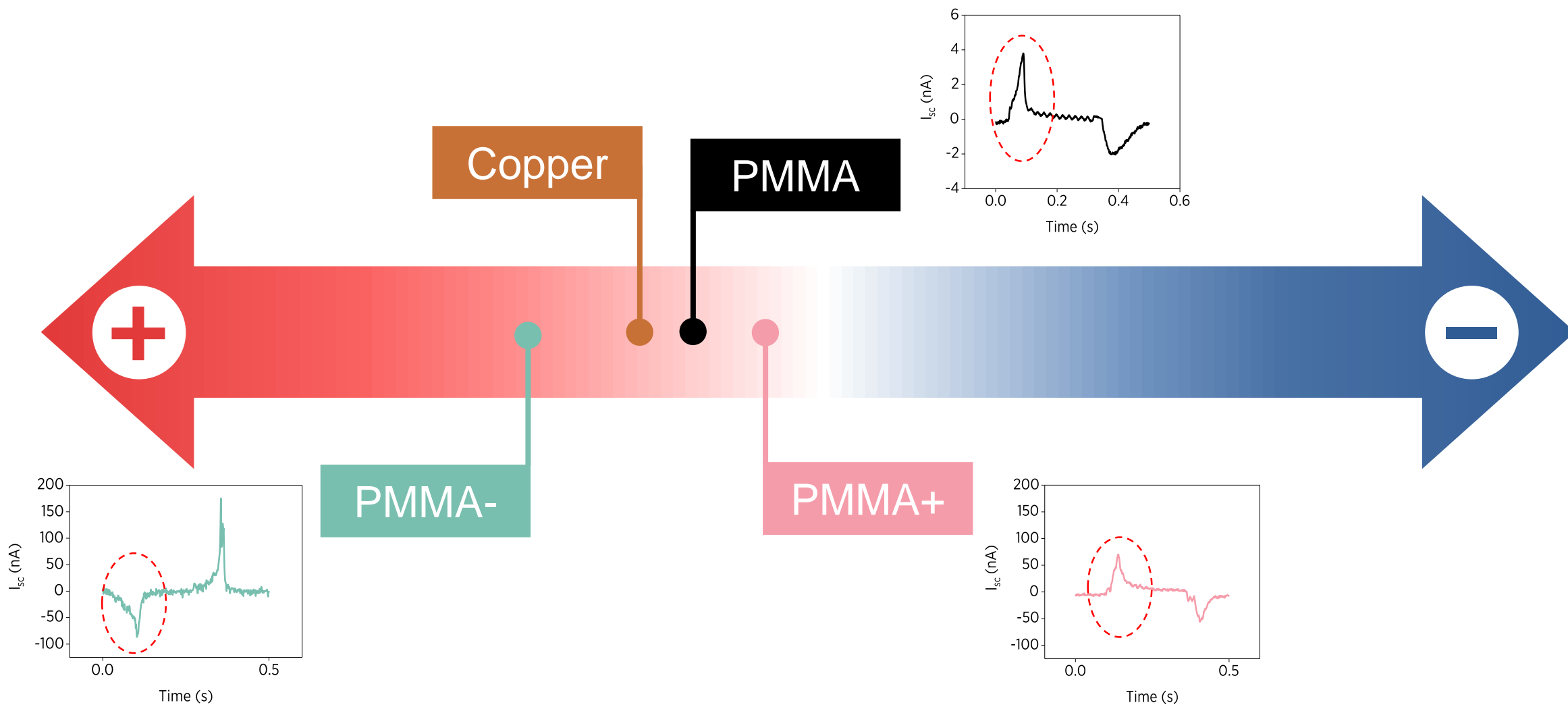
# Triboelectric performance



# Permanent surface modification



# Tailoring PMMA on the triboelectric series



# Conclusions

- The **triboelectric performance** of electrospun **PMMA fibers** can be **tailored** by tuning the polarity of the applied voltage while electrospinning.
- XPS, AFM and KPFM data correlate this result with **surface chemistry modification** of PMMA fibers during electrospinning.
- 5 times higher triboelectric performance is achieved in electrospun PMMA- fibers due to their surface chemistry modification.
- This fabrication method is **applicable** to **other polymers** to significantly increase their triboelectric output.

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Urszula Stachewicz – AGH University of Science and Technology, Krakow

Sohini Kar-Narayan – University of Cambridge

