

## Supplementary Materials

### Additional Materials and Methods for Anionic Polymerization of MAPOSS

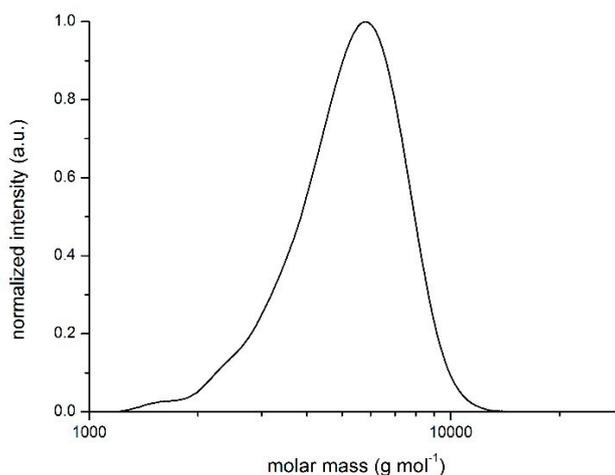
Tetrahydrofuran (THF) was distilled from sodium/benzophenone prior to the addition of 1,1'-diphenylethylene (DPE) and *n*-butyllithium (*n*-BuLi) followed by a second cryo-transfer. DPE was dried by adding a small amount of *n*-BuLi followed by cryo-transfer. Lithium chloride (LiCl) was dissolved in a small amount of freshly distilled THF and treated with *sec*-butyllithium. After stirring at room temperature for one hour, THF was removed in vacuo and dried LiCl was transferred and stored in a glovebox. MAPOSS was purified by recrystallization from methanol, dried in vacuum and stored in the fridge of a glovebox.

### Anionic Polymerization of MAPOSS

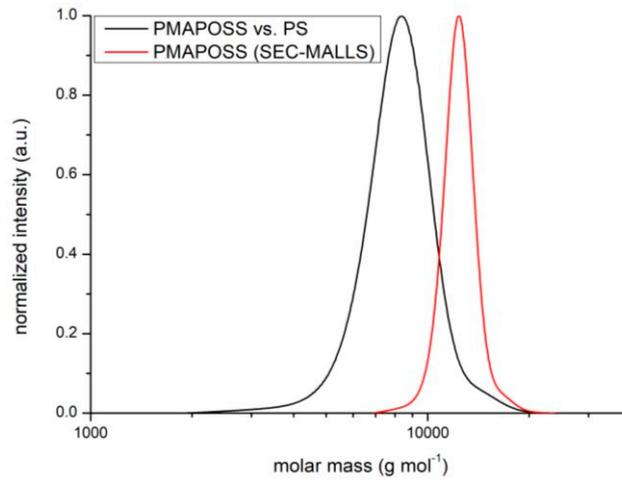
In an ampule equipped with a stirring bar 21 mg (0.49 mmol–10 eq. with respect to the living chain ends) of LiCl was dissolved in 40 mL of dry THF followed by the addition of 50  $\mu$ L of a 1.3 M solution of *sec*-BuLi in hexane with a syringe. After 16 h, 750 mg (0.79 mmol, 16.1 eq.) of MAPOSS was dissolved and cooled to  $-78$   $^{\circ}$ C. In a syringe a solution of 1 mL dry THF, 17  $\mu$ L (0.096 mmol, 2.0 eq.) of 1,1'-diphenylethylene and 31  $\mu$ L (0.049 mmol, 1.0 eq.) of *n*-BuLi (1.6 M in hexane) was prepared and precooled to  $-20$   $^{\circ}$ C. The initiator solution was quickly added to the MAPOSS solution to initiate the anionic polymerization. After 16 h the polymerization was quenched by adding a small amount of degassed methanol. The polymer was poured into a 10-fold excess of methanol, collected by filtration, washed with methanol and dried under vacuum (yield: 700 mg, 93%). SEC (vs. PS):  $M_n$ : 8100 g/mol,  $M_w$ : 8400 g/mol,  $D$ : 1.04. SEC-MALLS:  $M_w$ : 12 500 g/mol.

### Immersion of blank paper with PMAPOSS

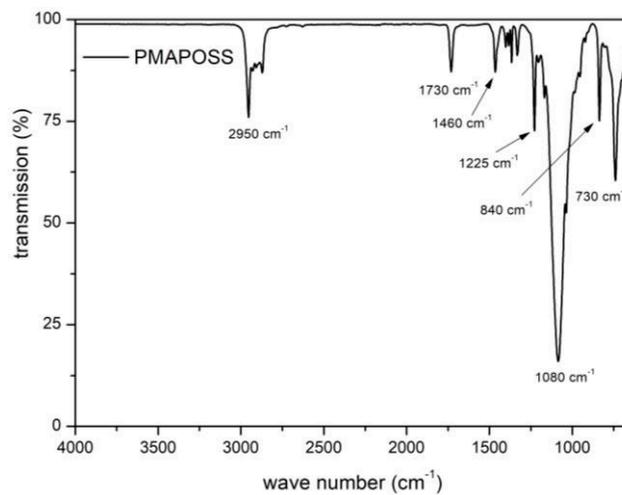
A blank paper sample ( $d = 1$  cm) was placed at the bottom of a vial ( $d = 1.1$  cm) and filled with a solution of PMAPOSS dissolved in 2 mL THF. After evaporation of the solvent, the immersed paper was thermal treated until 1600  $^{\circ}$ C under nitrogen.



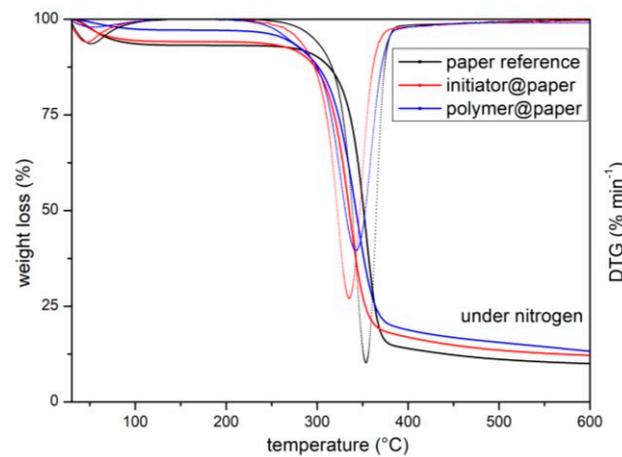
**Figure S1.** Molar mass distribution obtained by SEC measurements vs. PS standards in THF as eluent for PMAPOSS homopolymer obtained by ATRP in solution.



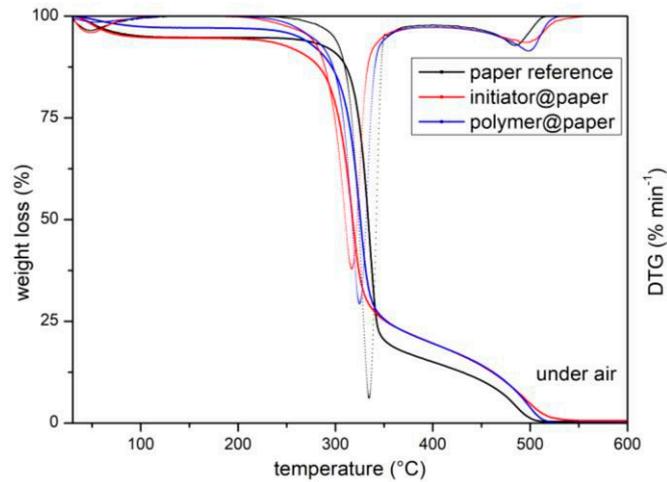
**Figure S2.** Molar mass distribution obtained by SEC measurements vs. PS standards in THF as eluent for PMAPOSS homopolymer synthesized by anionic polymerization (black line) and molar mass distributions obtained by SEC measurements performed with a MALLS-detector ( $dn/dc = 0.0593$ ).



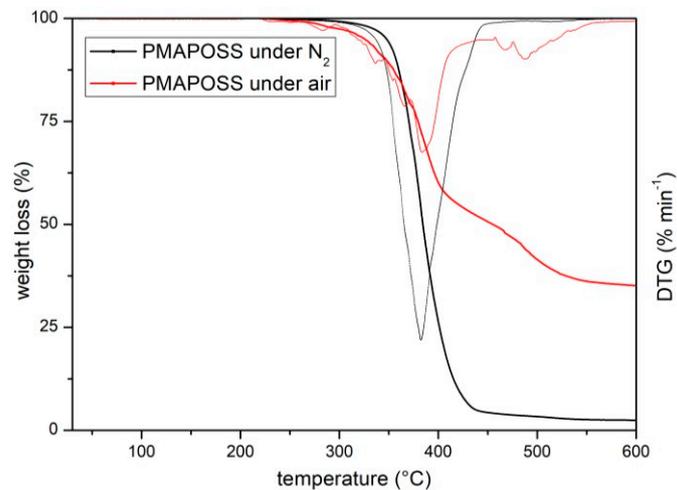
**Figure S3.** Infrared spectrum of PMAPOSS homopolymer synthesized by means of anionic polymerization.



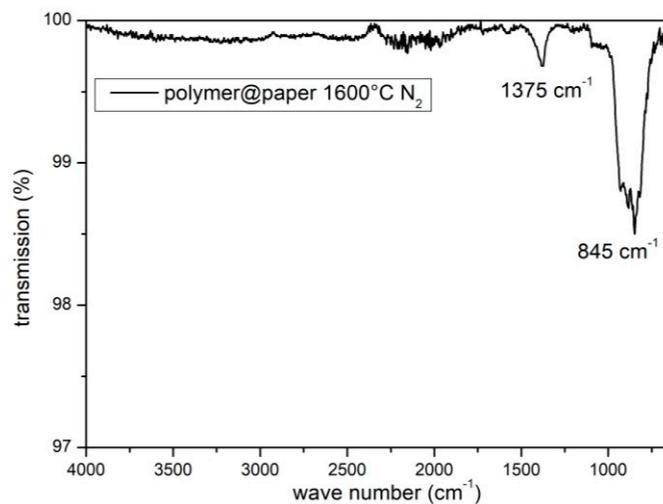
**Figure S4.** TGA (thick line) and DTG (thin dotted line) thermograms of the cellulose substrate reference (black), initiator functionalized paper (red) and PMAPOSS functionalized paper substrate (blue). TGA measurements were applied with a heat rate of  $10 \text{ K} \cdot \text{min}^{-1}$  in a nitrogen atmosphere until  $600 \text{ }^\circ\text{C}$ .



**Figure S5.** TGA (thick line) and DTG (thin dotted line) thermograms of the cellulose substrate reference (black), initiator functionalized paper (red) and PMAPOSS functionalized paper substrate (blue). TGA measurements were applied with a heat rate of  $10 \text{ K}\cdot\text{min}^{-1}$  under air until  $600 \text{ }^\circ\text{C}$ .



**Figure S6.** TGA (thick line) and DTG (thin dotted line) thermograms of PMAPOSS. Under a nitrogen atmosphere (black) or under air (red) until  $600 \text{ }^\circ\text{C}$ .



**Figure S7.** Infrared spectrum of PMAPOSS-modified cellulose substrate after thermal treatment up to  $1600 \text{ }^\circ\text{C}$  in nitrogen atmosphere.

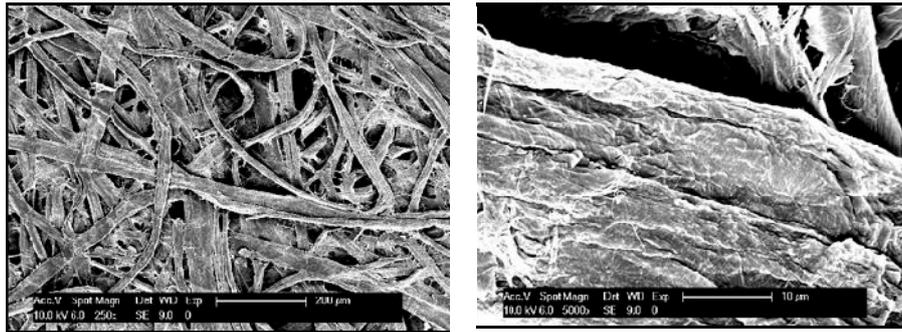


Figure S8. SEM photograph of a cellulose reference substrate prior to thermal treatment.

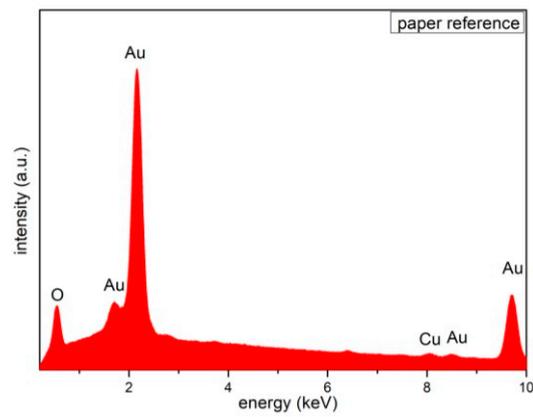


Figure S9. EDS spectrum of the reference cellulose substrate sputtered with gold.

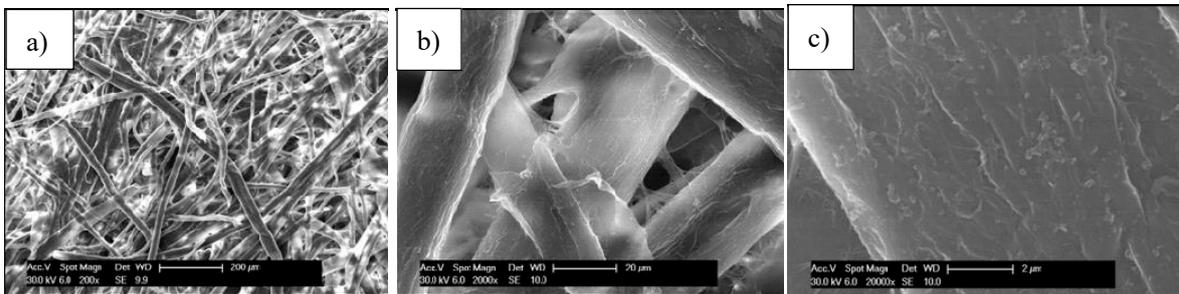


Figure S10. SEM images of PMAPOSS-modified cellulose substrate prior to thermal treatment.

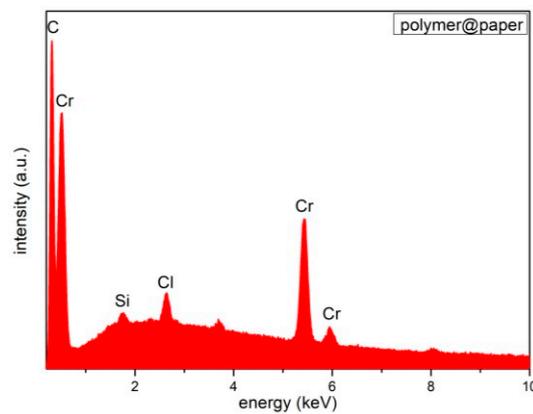
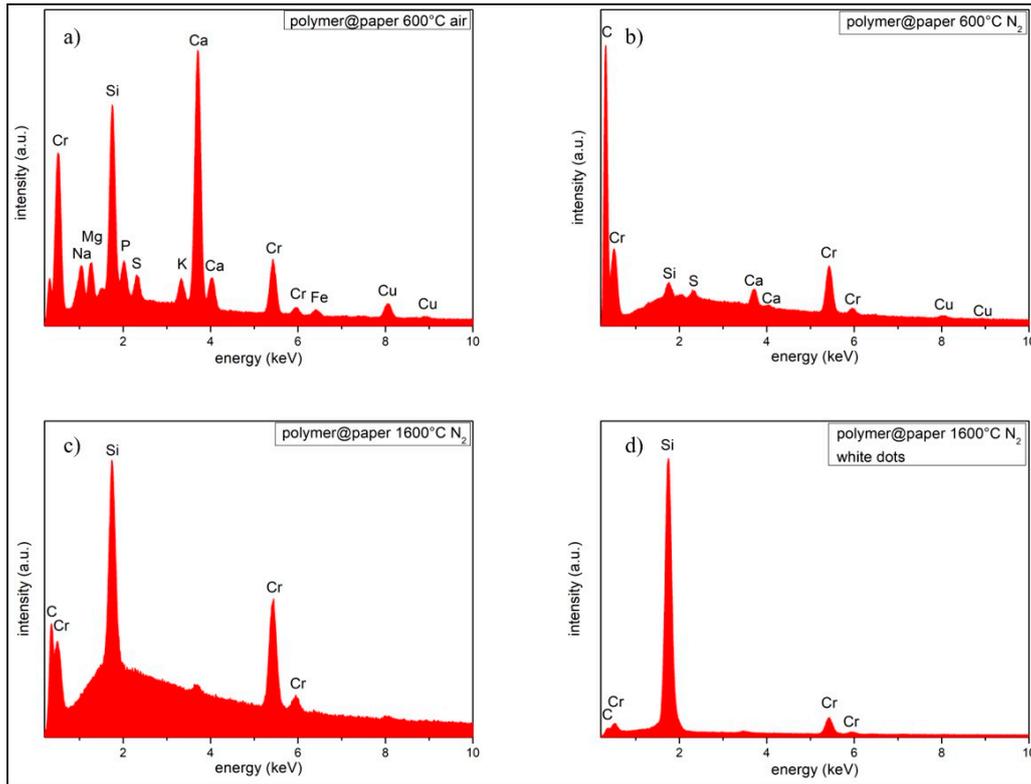
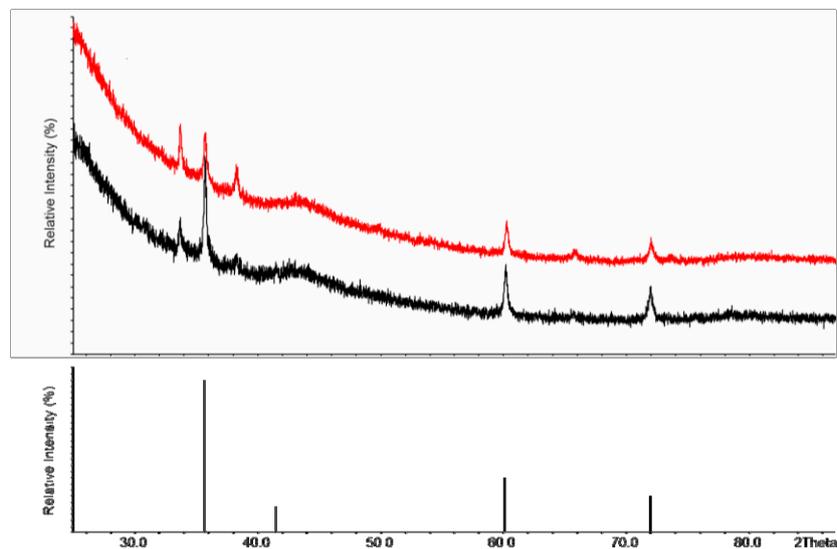


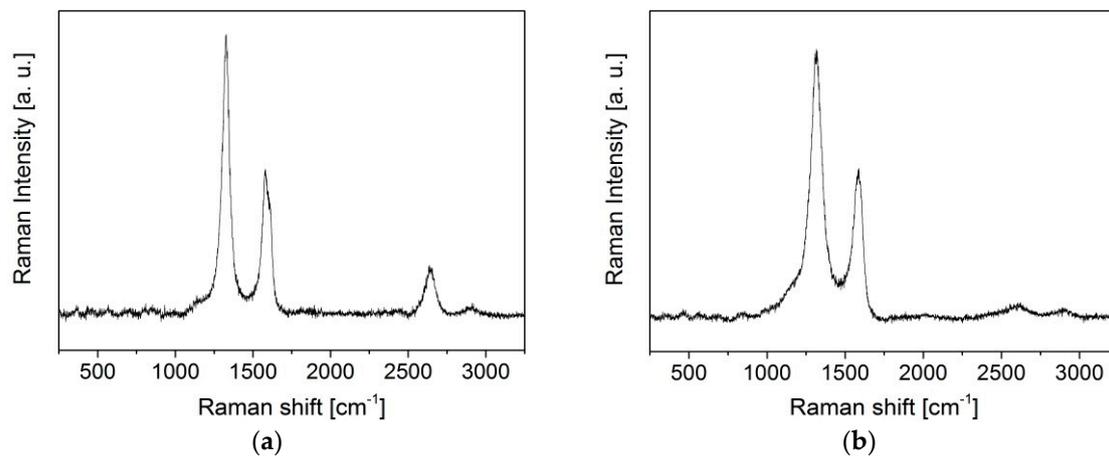
Figure S11. Corresponding EDS spectrum of PMAPOSS-modified cellulose substrate.



**Figure S12.** EDS spectra of PMAPOSS-modified cellulose substrates after thermal treatment up to 600 °C under air (a), under nitrogen (b), until 1600 °C under nitrogen (c) and exemplary EDS spectra of a bright appearing domain of a PMAPOSS-modified cellulose substrate after thermal treatment at 1600 °C under nitrogen (d). The samples were sputtered with Cr for SEM measurement.



**Figure S13.** Experimental X-ray powder patterns of PMAPOSS functionalized paper substrate (black) and PMAPOSS functionalized reference paper substrate coated from a PMAPOSS solution (red) after thermal treatment up to 1600 °C under nitrogen compared to literature data for  $\beta$ -SiC (JCPDS 73-1665). The additional reflections observed at 33.75°, 38.29° and 65.79°/2 $\theta$  might be due to stacking faults as describes in [64].



**Figure S14.** Raman spectra of PMAPOSS functionalized paper substrate (a) and PMAPOSS functionalized reference paper substrate coated from a PMAPOSS solution (b) after thermal treatment up to 1600 °C under nitrogen.