Supporting Information

Femtosecond laser-induced scratch ablation as an efficient new method to evaluate the self-healing behavior of supramolecular polymers

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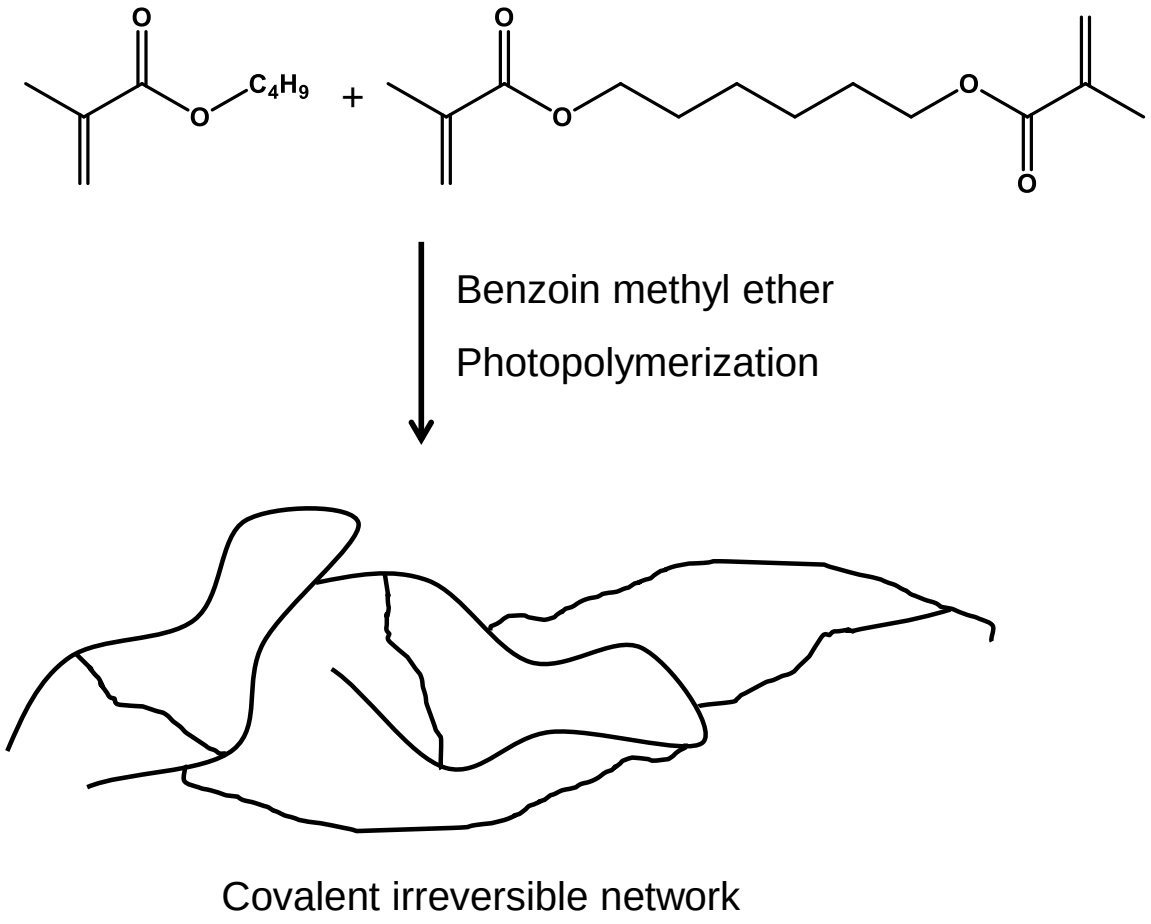
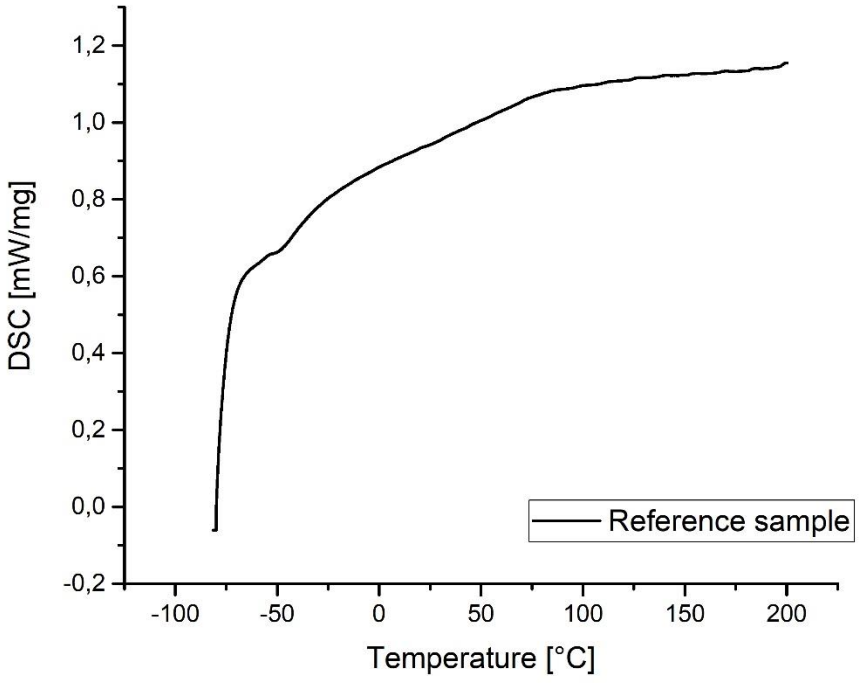
Experimental section:

All polymer syntheses were performed according to Bode *et al*..[31]

Schemes figures and tables:



Scheme S1: Schematic representation of the synthesis of the reference samples $\mathbf{S_R}$.



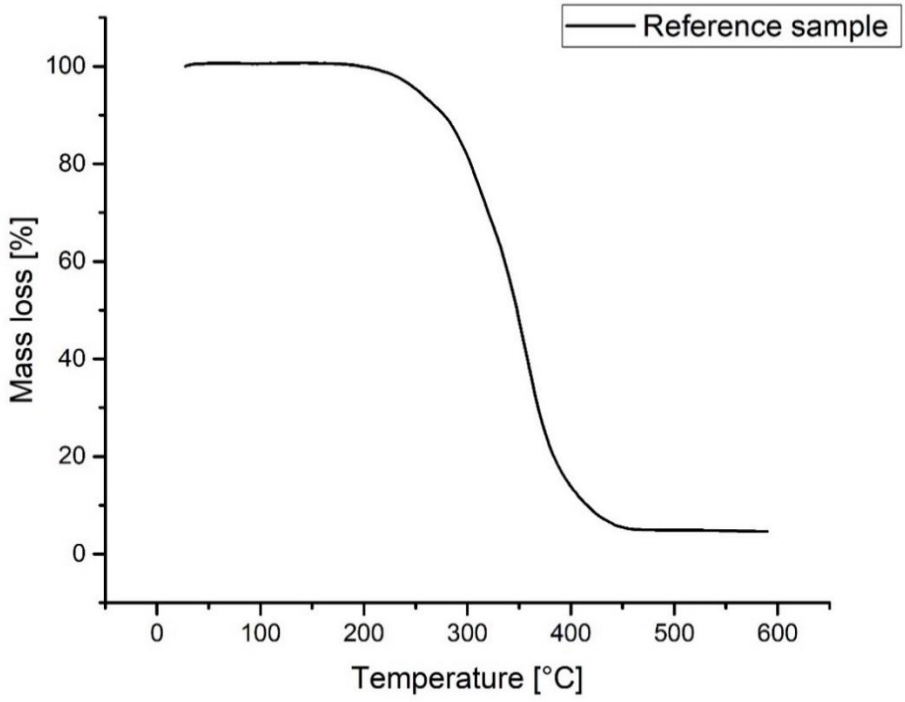


Figure S1: DSC curves (2nd heating) and TGA of the reference sample.

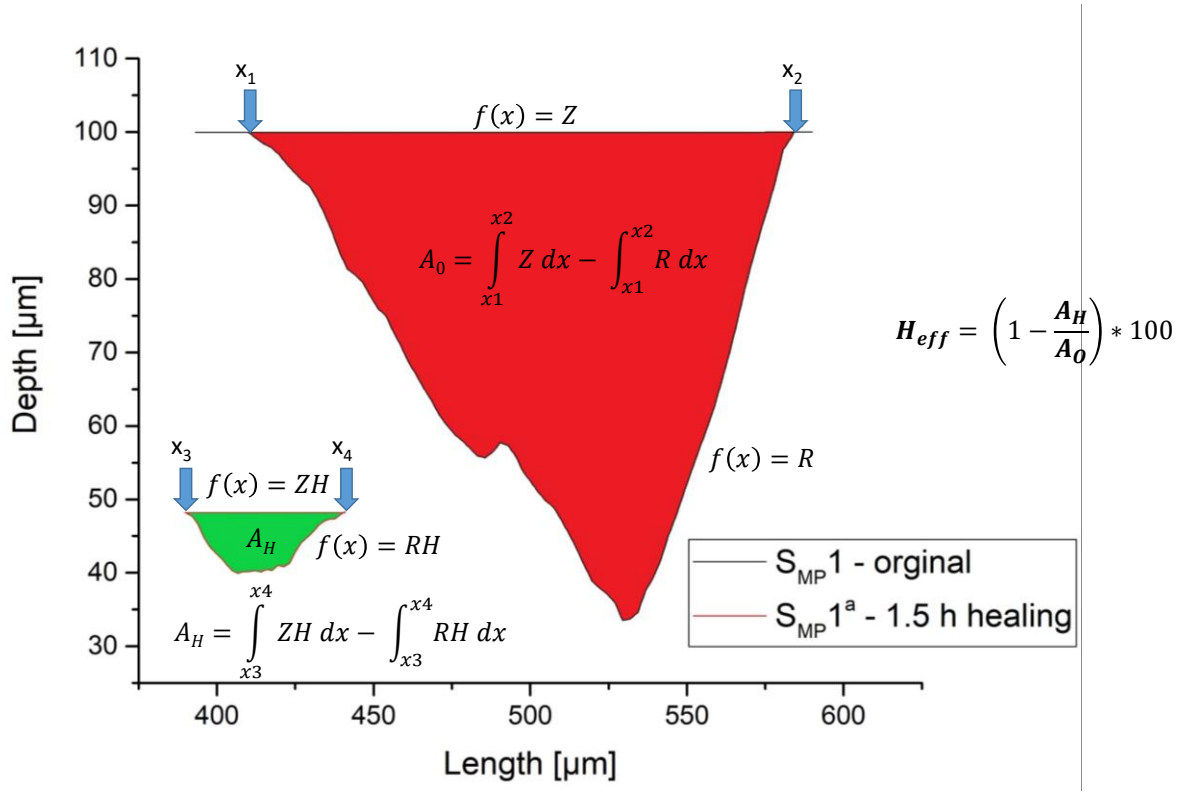


Figure S2: Schematic representation of the calculation of A_0. Integration of the areas below the zero line and the curve. Simple subtraction results in the profile area.

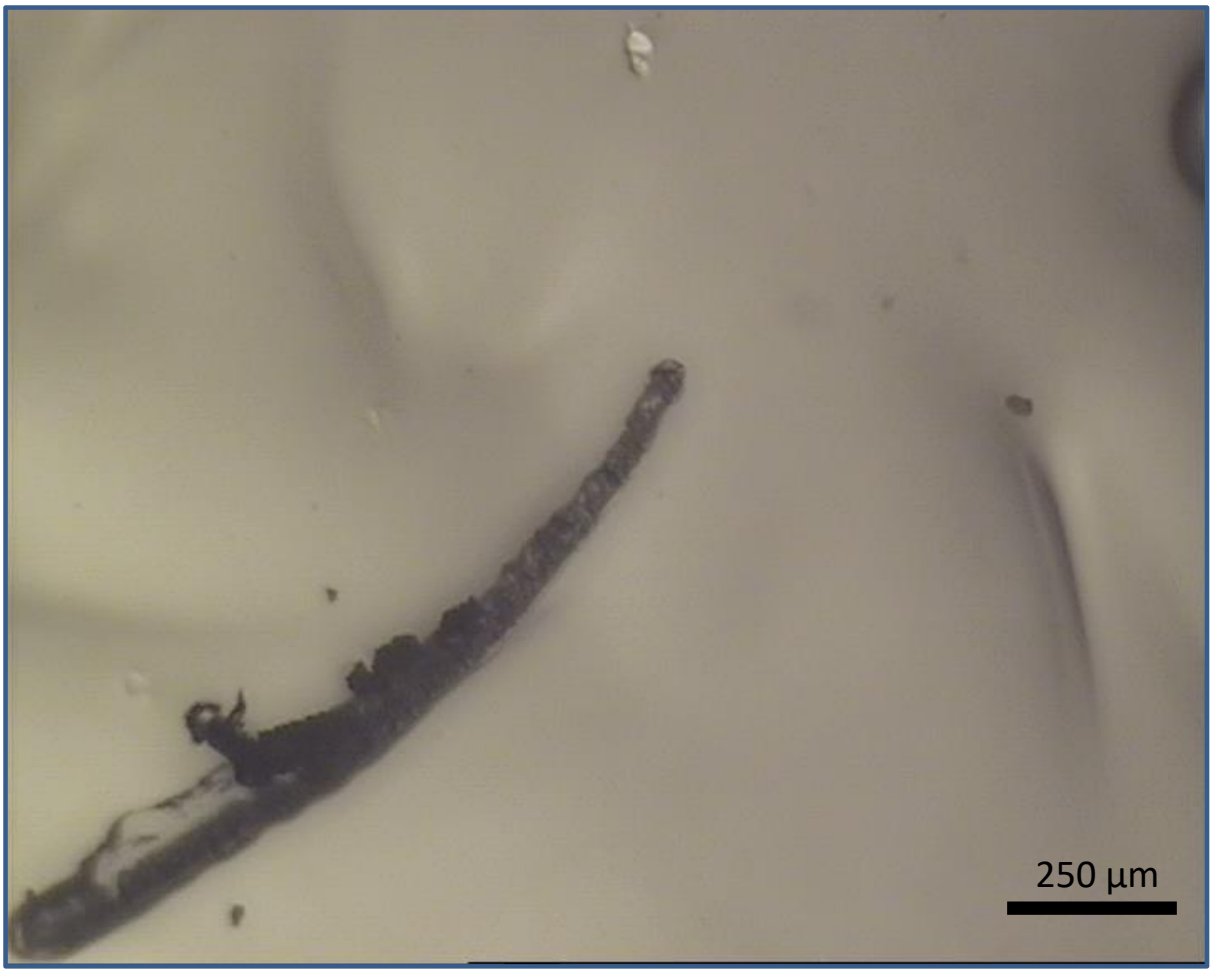


Figure S3: Crack made with a scalpel induced into the metallopolymer based on poly(butyl methacrylate) crosslinked via manganese(II)-chloride-terpyridine interactions. Cracks and ridges can be seen on the crack edge.

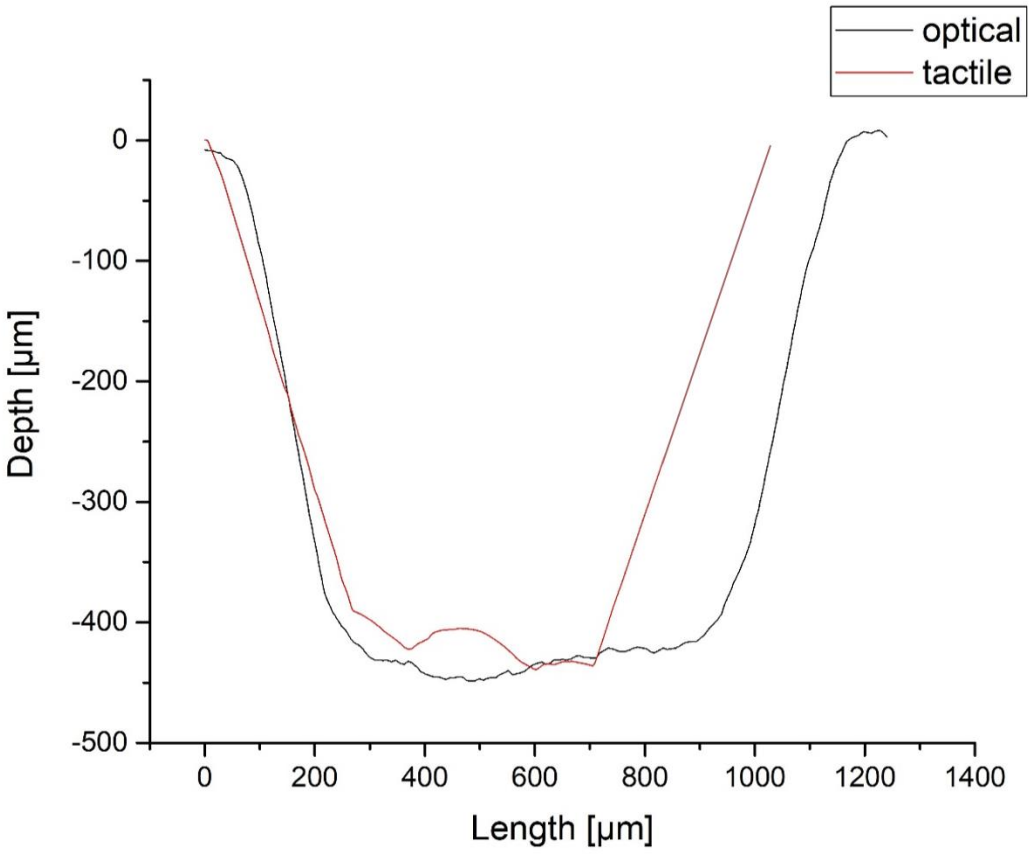
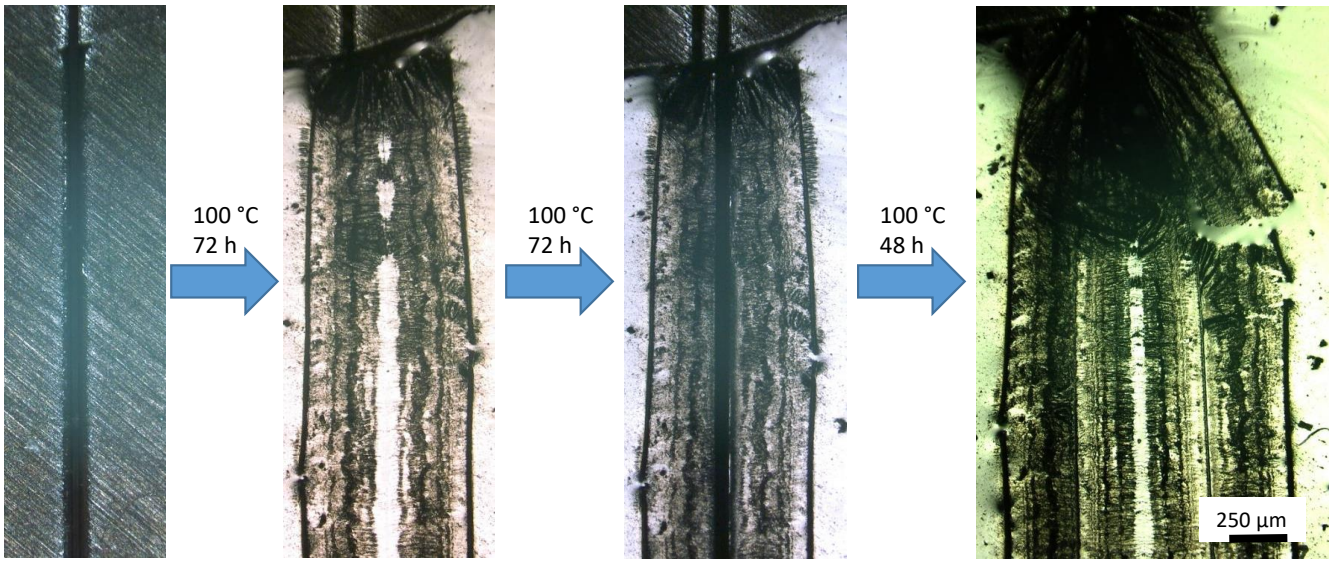


Figure S4: Comparison of optical and tactile measurement of a defect in the metallopolymer.



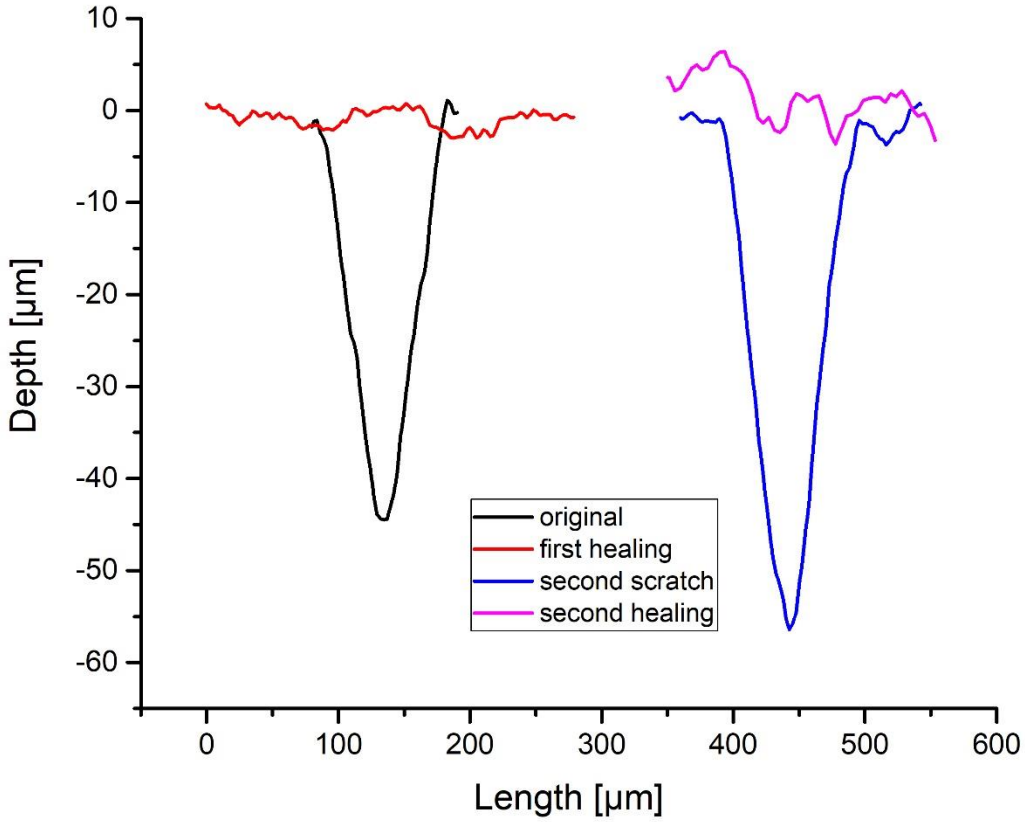


Figure S5: Comparison of multiple healing, left side: first healing, right side: second healing. The polymer was processed with the same laser parameter as for sample **SMP3**.

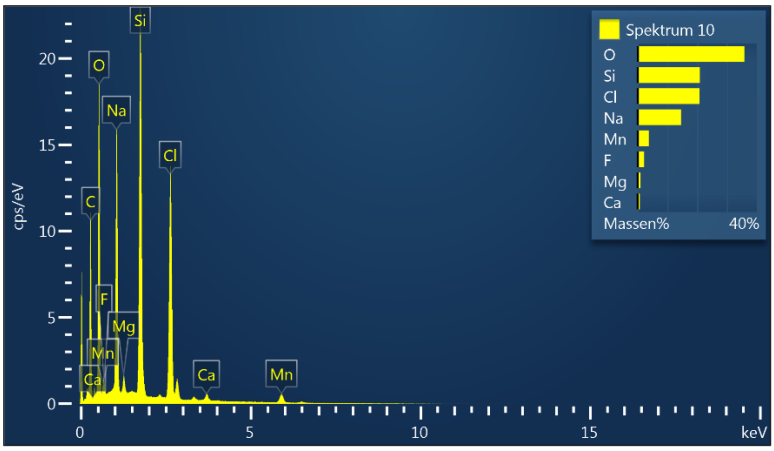


Figure S6: EDX measurement at area C of the scratch **SMP4**; due to the high laser intensity the polymer and even the glass were sublimated. Components of the glass can be detected on the surface.

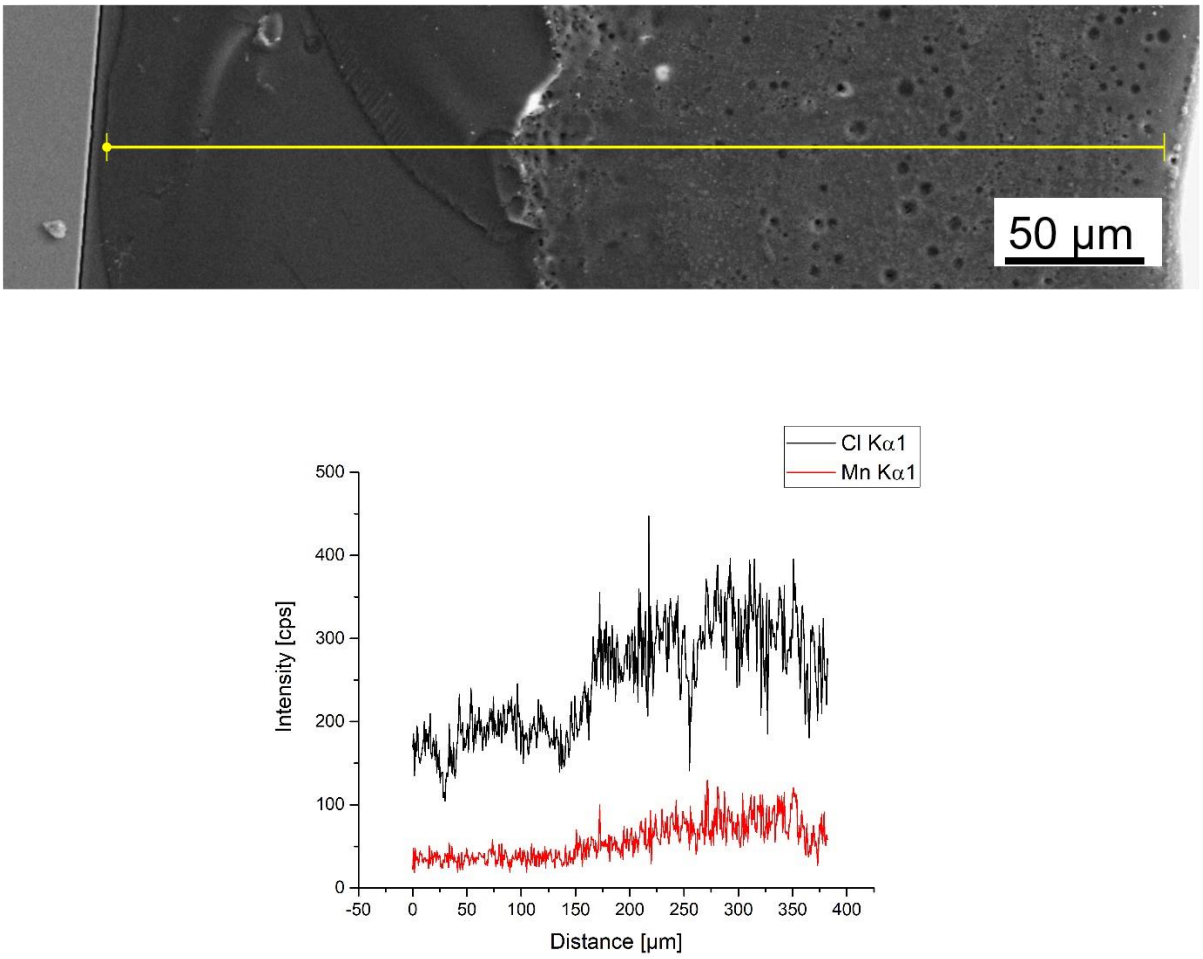


Figure S7: Line scan sample **SMP4** from point A to B. A higher amount of manganese in the sublimated polymer range was found.

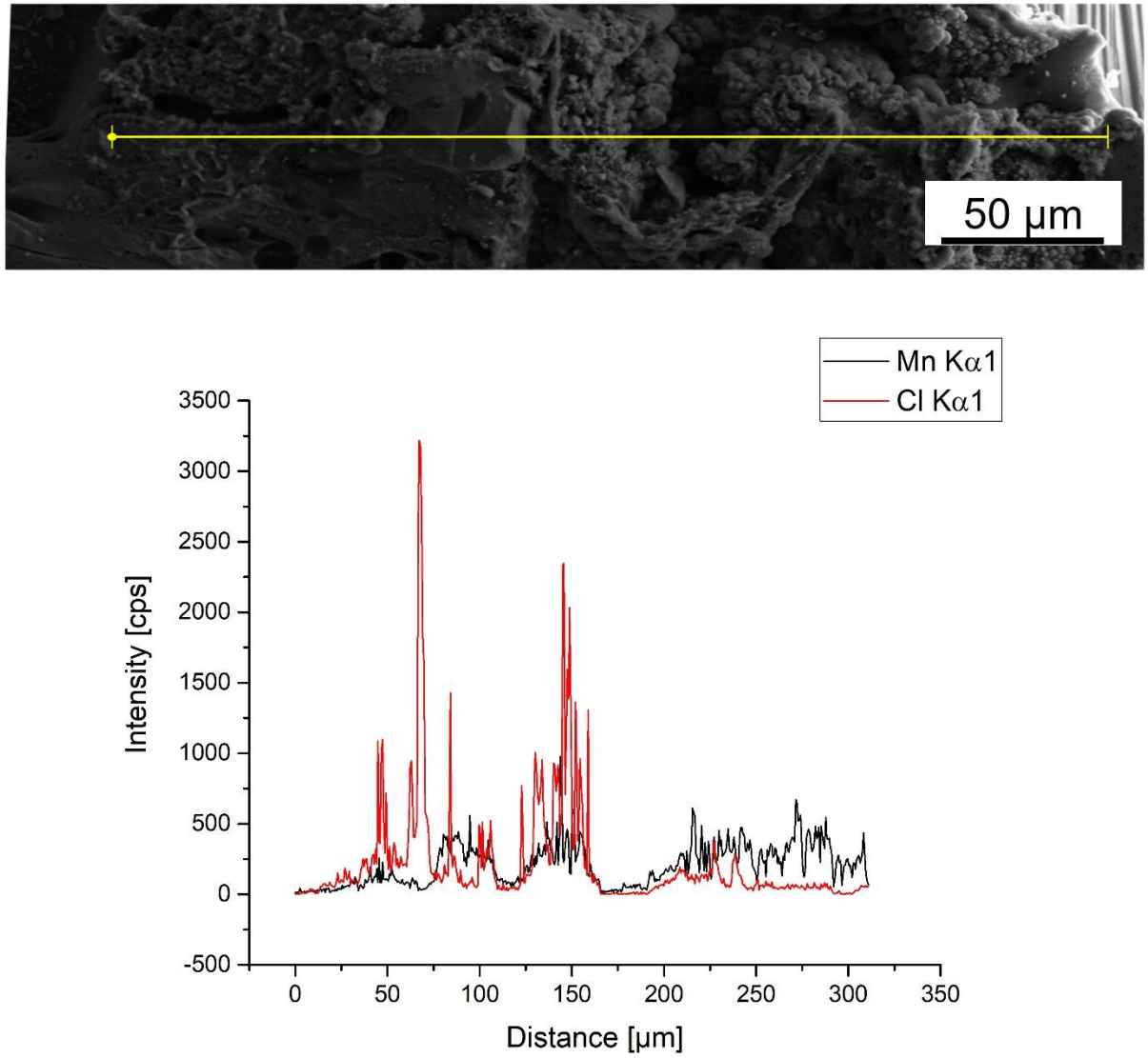
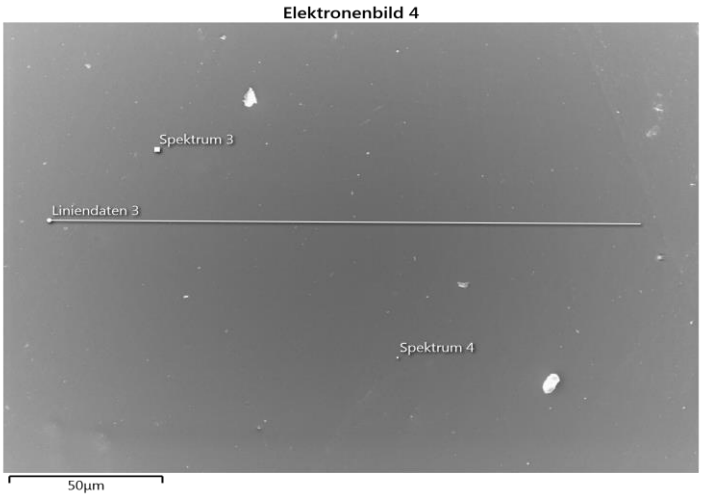


Figure S8: Line scan of sample **S_{MP}4** from point C to D. The complexing agent is distributed irregularly. The intensive laser radiation has destroyed the surface.



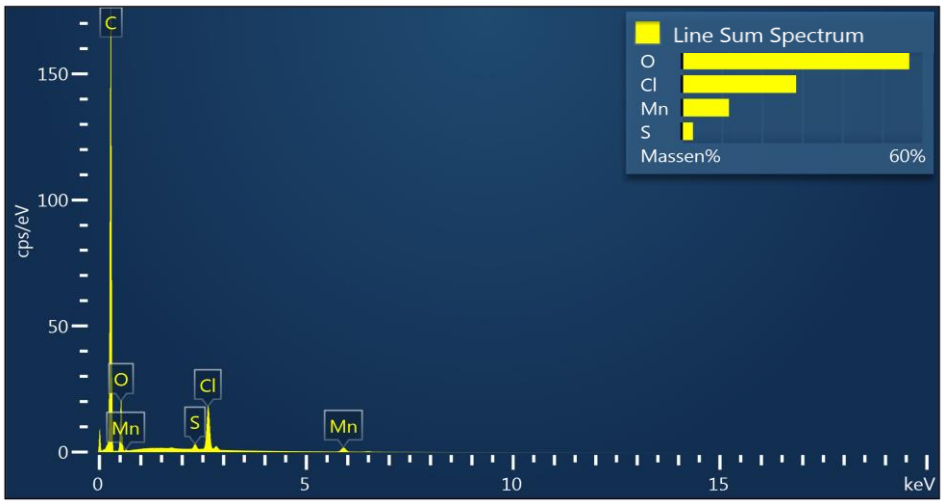


Figure S9*:* Line sum spectrum of EDX measurement at the polymer surface before healing.

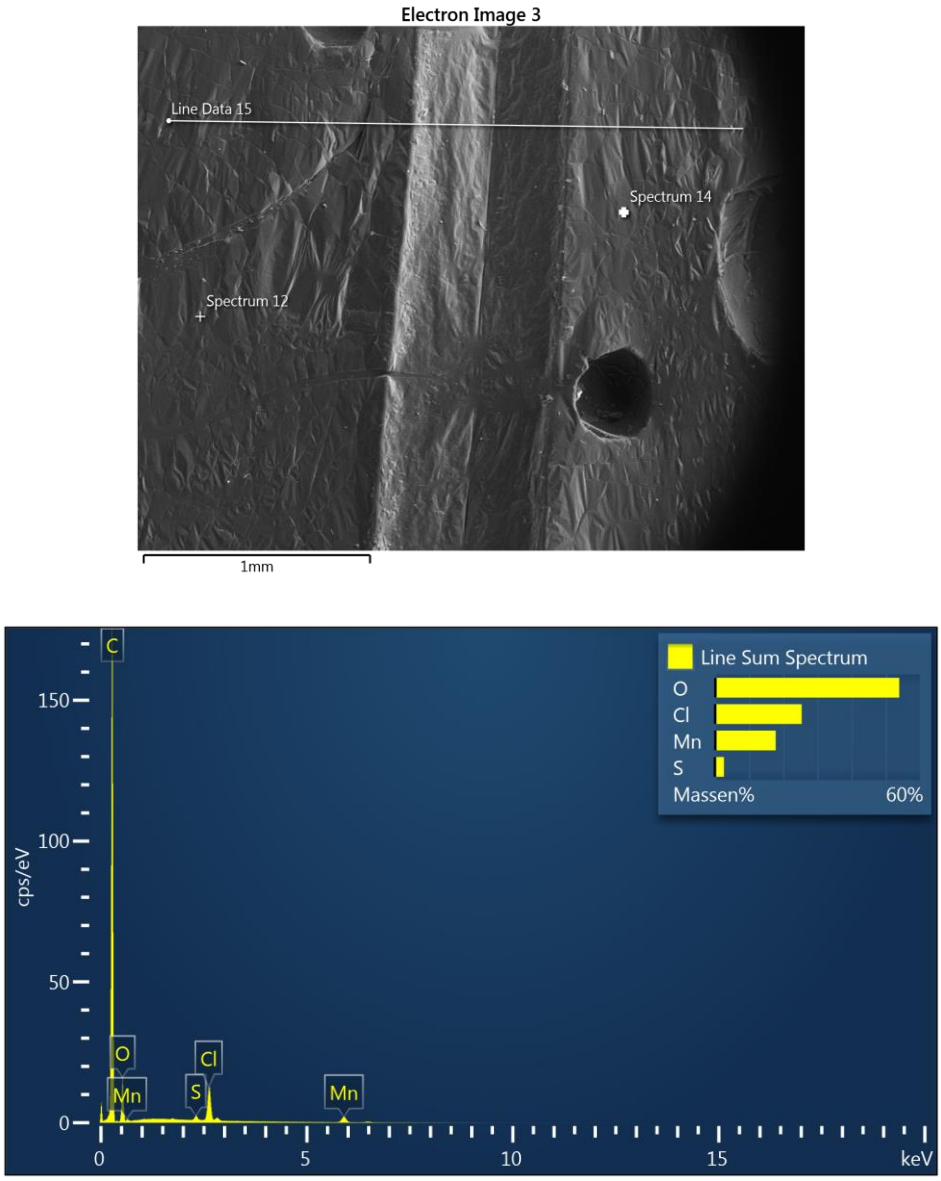


Figure S10: Line sum spectrum of EDX measurement at the polymer surface after healing. The polymer was processed with the same laser parameter as for sample **SMP3**.

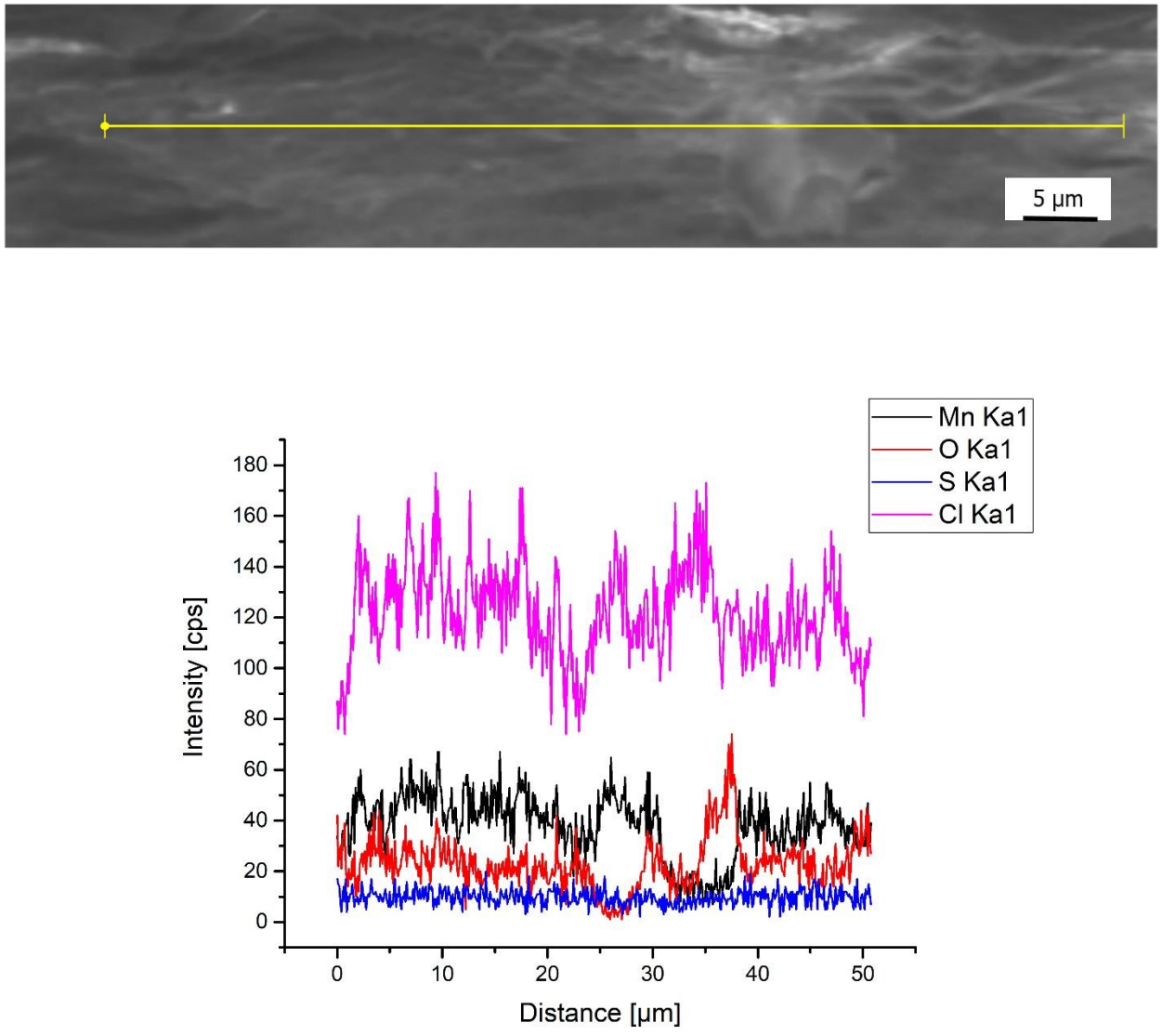


Figure S11*:* Line scan of a metallopolymer at a scratch flank before healing. The present elements are equally distributed. The polymer was processed with the same laser parameter as for sample **S_{MP}3**.

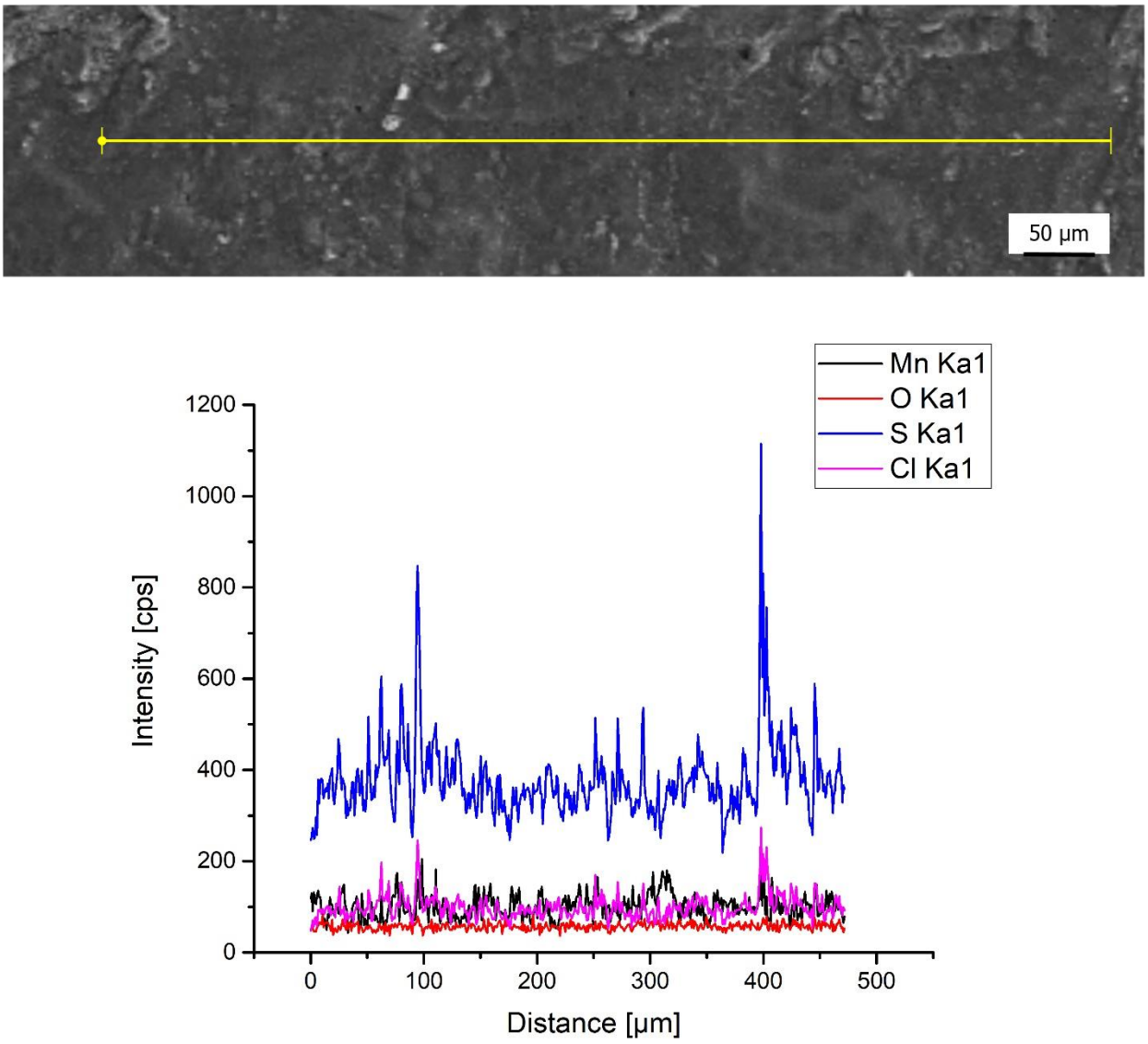
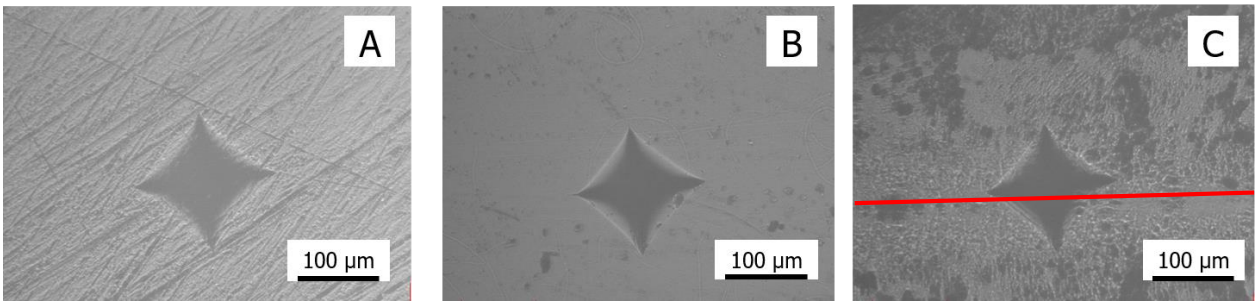


Figure S12: Line scan of a metallopolymer at a scratch flank after healing. The present elements are equally distributed. The polymer was processed with the same laser parameter as for sample **SMP3**.



Reference, next to the scratch (A)		Healed scratch	
Left side	**Right side**	**Next to scratch (B)**	**In scratch (C)**
5.2 HV 0.1/30	5.1 HV 0.1/30	6.2 HV 0.1/30	6.2 HV 0.1/30

Figure S13: Hardness test according to Vickers with a load of 0.1 N and a load duration of 30 seconds. Figure A and Figure B show measurements near to the scratch before and after healing. Figure C shows a measurement in scratch area after healing. The red line indicates the center of the healed scratch.