Supporting Information

Polysiloxane layers created by sol-gel and photochemistry: Ideal surfaces for rapid, low-cost and high-strength bonding of epoxy components to polydimethylsiloxane

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Supplementary XPS scans

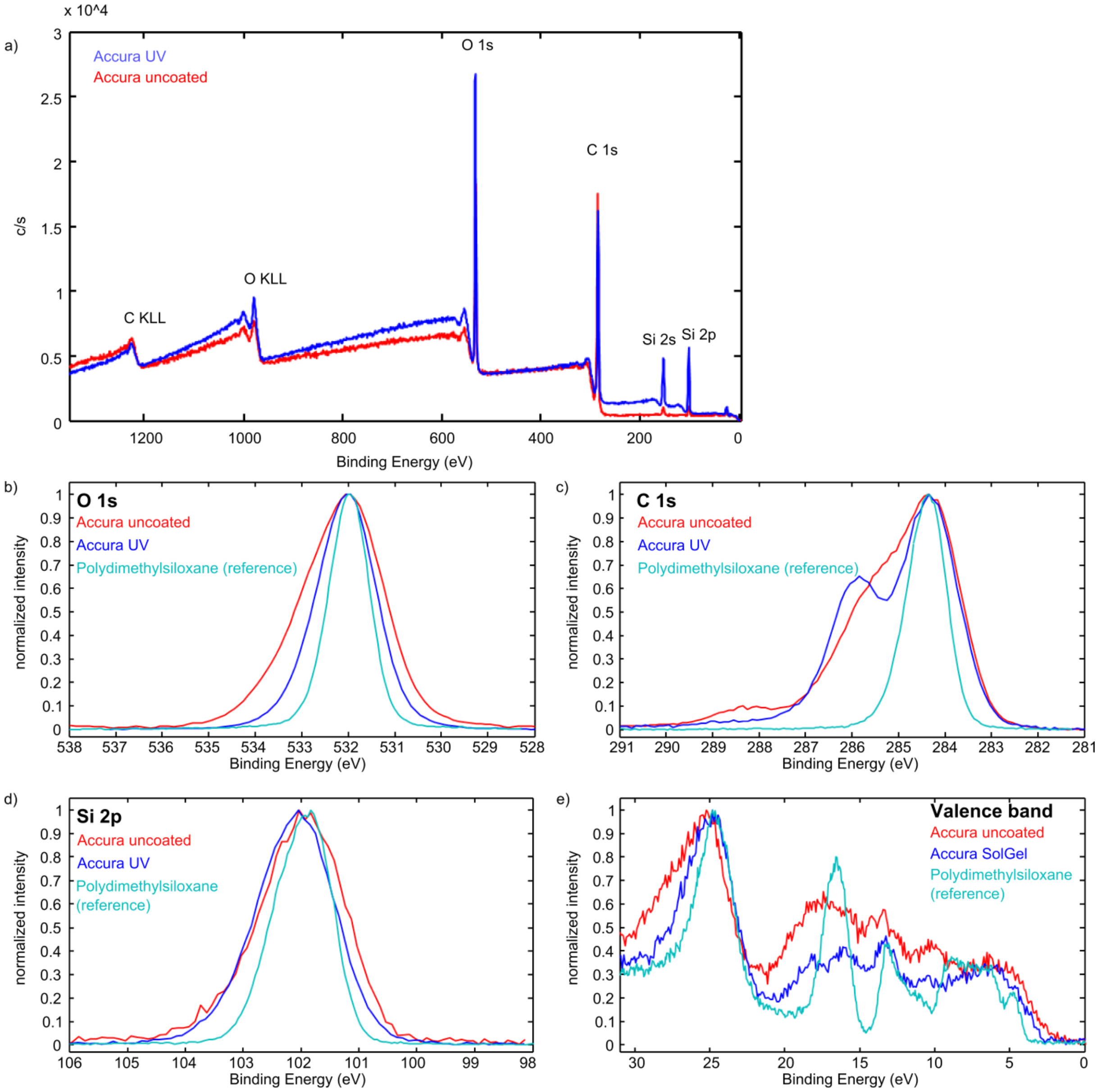

Fig. S1 Survey (a) and narrow XPS scans of O 1s (b), C 1s (c), Si 2p (d), and valence band (e) of Accura 60 samples are compared with reference spectra of pure polydimethylsiloxane (PDMS) have been taken from literature (Beamson and D. Briggs, eds., *The XPS of polymers database*, SurfaceSpectra Ltd., Manchester, UK, 2000). As depicted the spectra of pure Accura 60 samples show a divergence from the reference spectra. The samples, which have been coated with (3-glycidoxypropyl)trimethoxysilane (GPTMS) using UV-light induced silanization, show similar behavior in all scans to those of pure Accura 60. This might be due to the fact that GPTMS itself contains an epoxy group.

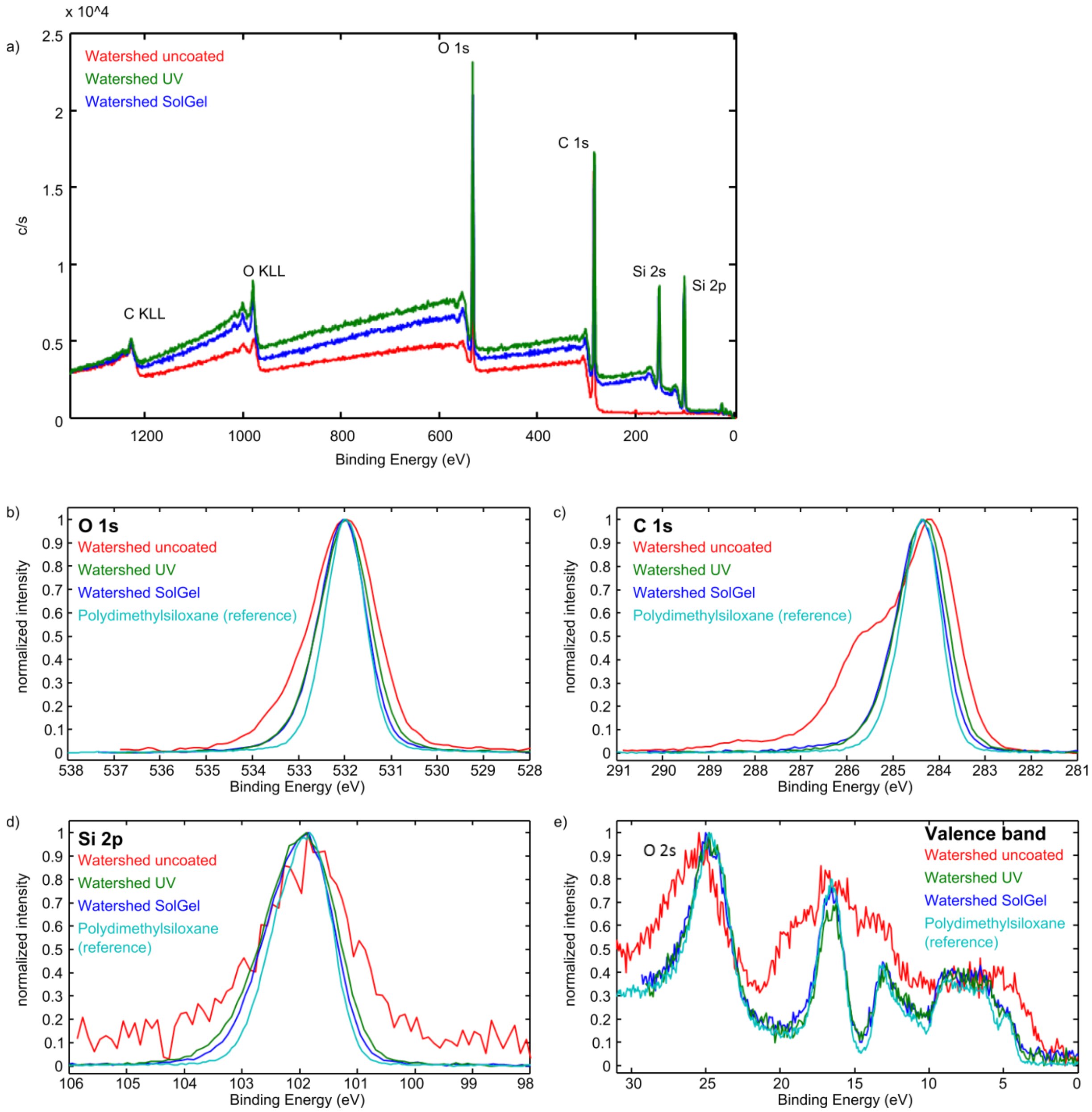

Fig. S2 Survey (a) and narrow XPS scans of O 1s (b), C 1s (c), Si 2p (d), and valence band (e) of pure and coated Watershed XC 11122 samples. Spectra of the samples, which have been coated with dimethoxydimethylsilane (DMDMS) are almost identical with the spectrum of pure PDMS which has been taken from the literature (Beamson and D. Briggs, eds., *The XPS of polymers database*, SurfaceSpectra Ltd., Manchester, UK, 2000). As depicted the samples which have been coated using the UV-light induced method show similar results to those that have been coated using the sol-gel method. Thus the method used for applying the silane does not influence the chemical composition of the created layer. The curves of pure Watershed XC 11122, which were obtained using the same method show significant differences compared to the PDMS reference.

Supplementary ATR- IR spectra

ATR- IR spectra were measured using a Bruker Tensor 27 FTIR-spectrometer (Bruker Optics, Ettlingen, Germany) equipped with a room temperature deuterated tri glycinesulfate (RT-DTGS) detector and a Bruker Platinum ATR accessory (diamond crystal with one reflection). All spectra were recorded at room temperature (ca. 22 °C). Bruker OPUS® 7.2 software was used for measurements as well as spectra evaluation. Spectra were recorded from 4000 cm^{-1} to 370 cm^{-1} with a spectral resolution of 4 cm^{-1} against an air background. In each measurement thirty two scans were co-added.

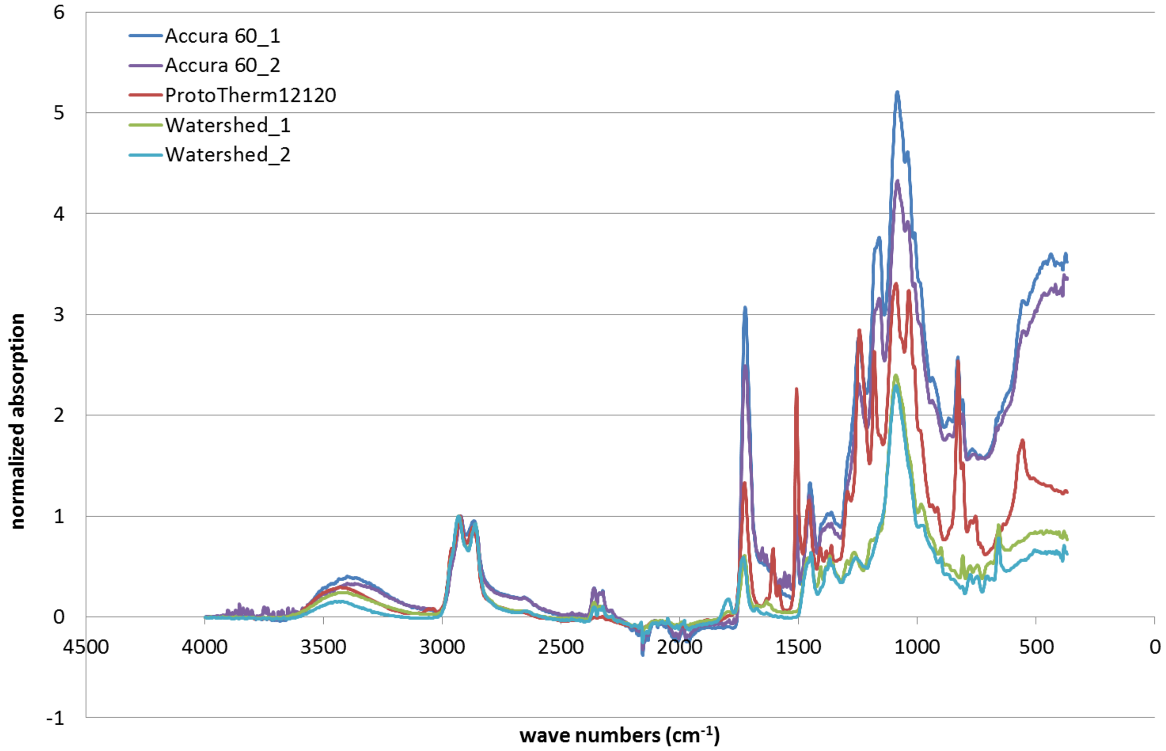

Fig. S3 ATR- IR spectra of the pure epoxy resins. As depicted no significant differences between the cured resins can be found in the survey scan.

Supplementary SEM images

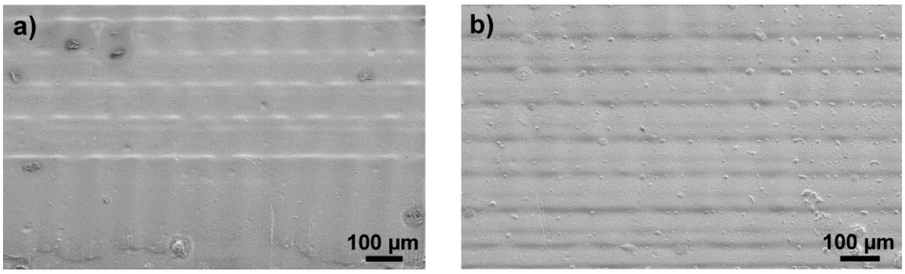

Fig. S4 SEM images of DSM 12120 HT (100 × magnification). a) The uncoated sample shows the stripped structure that is commonly found on all stereolithographically structured components. b) After UV-light based silanization with DMDMS small agglomerates of silane can be found on the surface. However, the agglomerates are smaller than the structure that comes from the manufacturing process.

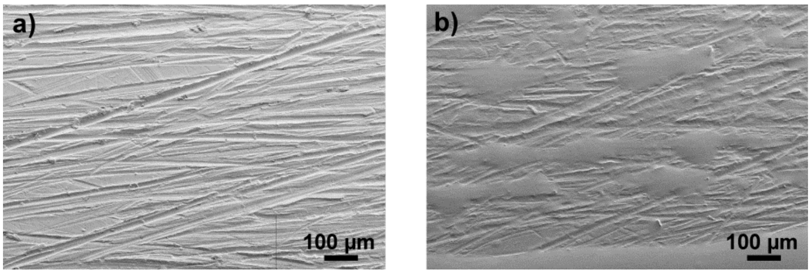

Fig. S5 SEM images of Watershed XC 11122. a) Unlike the samples of the other epoxies the Watershed XC 11122 samples have been produced by filling the prepolymer into a PDMS mold and polymerizing it by means of UV light induced polymerization. Thus these samples do not exploit the pattern that can be found on the stereolithographically structured epoxies. However during the casting process small grooves have been created on the surface. b) The grooves can also be seen after UV-light induced polymerization of DMDMS on the surface. However they are not as big as the agglomerates of the polymerized siloxane layer.

Samples that have been coated with DMDMS using the sol-gel process did repel the silver layer necessary for SEM imagine. Thus they show many dark spots and have therefore not been included in the ESI.

Contact angle measurement with solvents of different polarity

To determine the difference between the epoxies that bond with GPTMS and the ones that are bonded with DMDMS contact angle measurement with solvents of different polarity were carried out on a contact angle measurement microscope similar to the G-1 (purchased from Erma Inc., Japan) using sessile drop method. 1-Propanol, 2-propanol, ethanol, 1-pentanol, and octanol wetted the surface completely so that the contact angle of these materials could not be determined. The results for ethylene glycol, diiodomethane, glycerol, and bidestilled water are listed in table 1. As depicted the values do not show a specific difference between Accura 60 which can be bonded using GPTMS and the other two resins that are bonded with DMDMS. Thus we found this information unsufficient for predicting which silane should be used.

Solvent	Surface tension [mN/m]	Accura 60 [°]	Watershed XC 11122 [°]	DSM Somos 12120 HT [°]
Ethylene glycol	47,7 [1]	21.5 ± 3.33	36 ± 2.61	29 ± 3.16
Diiodomethane	50 [1]	33.83 ± 4.22	31.67 ± 4.89	28 ± 1.26
Glycerol	63,4 [1]	52.67 ± 3.2	68.5 ± 5.5	56.5 ± 2.88
Bidestilled water	72,75 [1]	62.83 ± 3.13	75.67 ± 3.39	75.33 ± 3.5

Table 1: Contact angle measurement on polished epoxy samples using solvents with different polarity. As depicted no significant difference between Accura 60 (bonded with GPTMS) and the other two epoxies (bonded with DMDMS) can be detected.

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[1] *KRÜSS, Liquids: Values for the surface tension of liquids, Retrieved from http://www.kruss.de/services/education-theory/substance-data/liquids/ (28/01/15)*