Supporting information of:

Quantifying Mechanical Abrasion of AgNP Nanocomposites: Influence of AgNP content on abrasion products and rate of microplastic production

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Artificial sea water composition:

Cl^-=19.3, Na^+=10.7, SO_4^{2-}=2.6, Mg=1.3, K^+=0.4, Ca^{2+}=0.4 and CO_3^{2-}=0.2 g/L

Moderately hard freshwater composition:
96 mg/L $NaHCO_3$, 60 mg/L $CaSO_4 \cdot 2H_2O$, 60 mg/L $MgSO_4$, 4 mg/L KCl

Table S1: Standard deviations for abrasion rates

Sample	Low Power Slope of Regression	Standard Error of Slope	High Power Slope of Regression	Standard Error of Slope	p-value
PETG	0.0355	0.014	0.1179	0.1514	1.279e-06
0.5% Ag	0.0433	0.0296	0.1014	0.0615	2.2e-16
2% Ag	0.0341	0.0248	0.0965	0.1468	4.47e-16

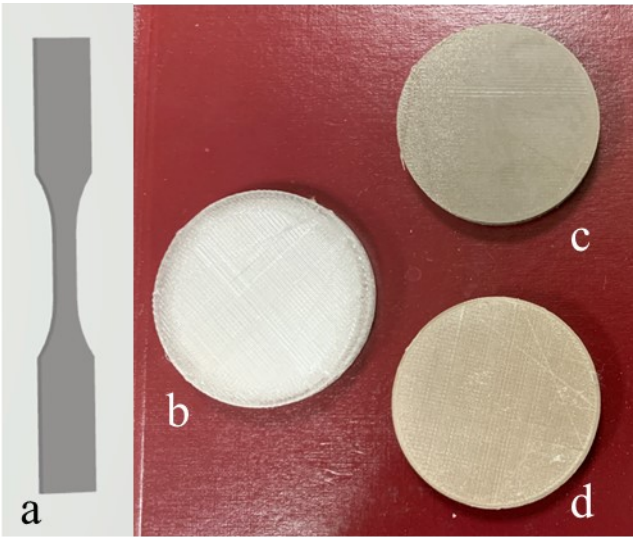

Figure S1: a) shape of an ASTM dogbone and the PETG (b), 2%Ag (c), and (d) 0.5%Ag pucks.

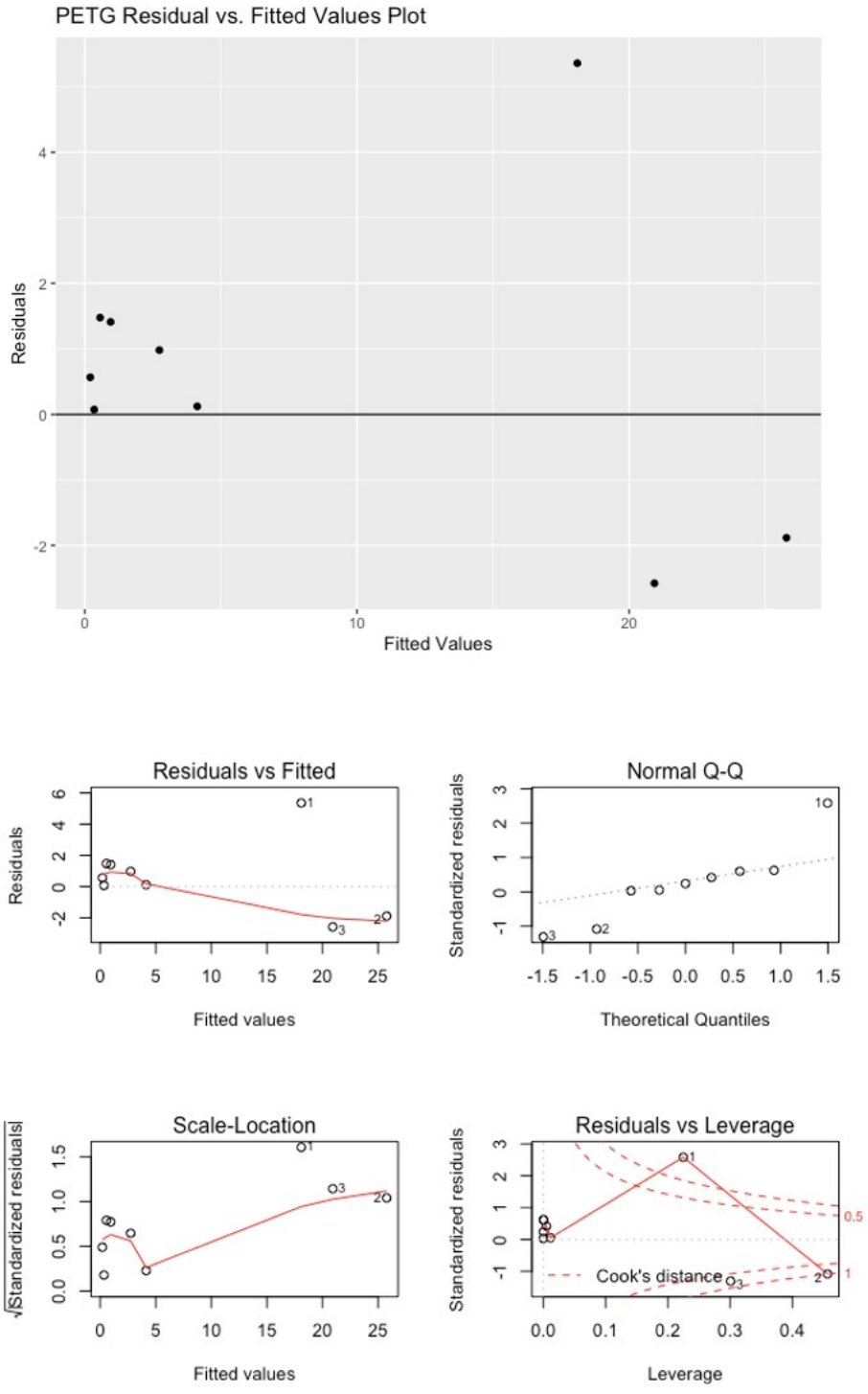

Figure S2: PETG Statistical Tests with Residual Plot

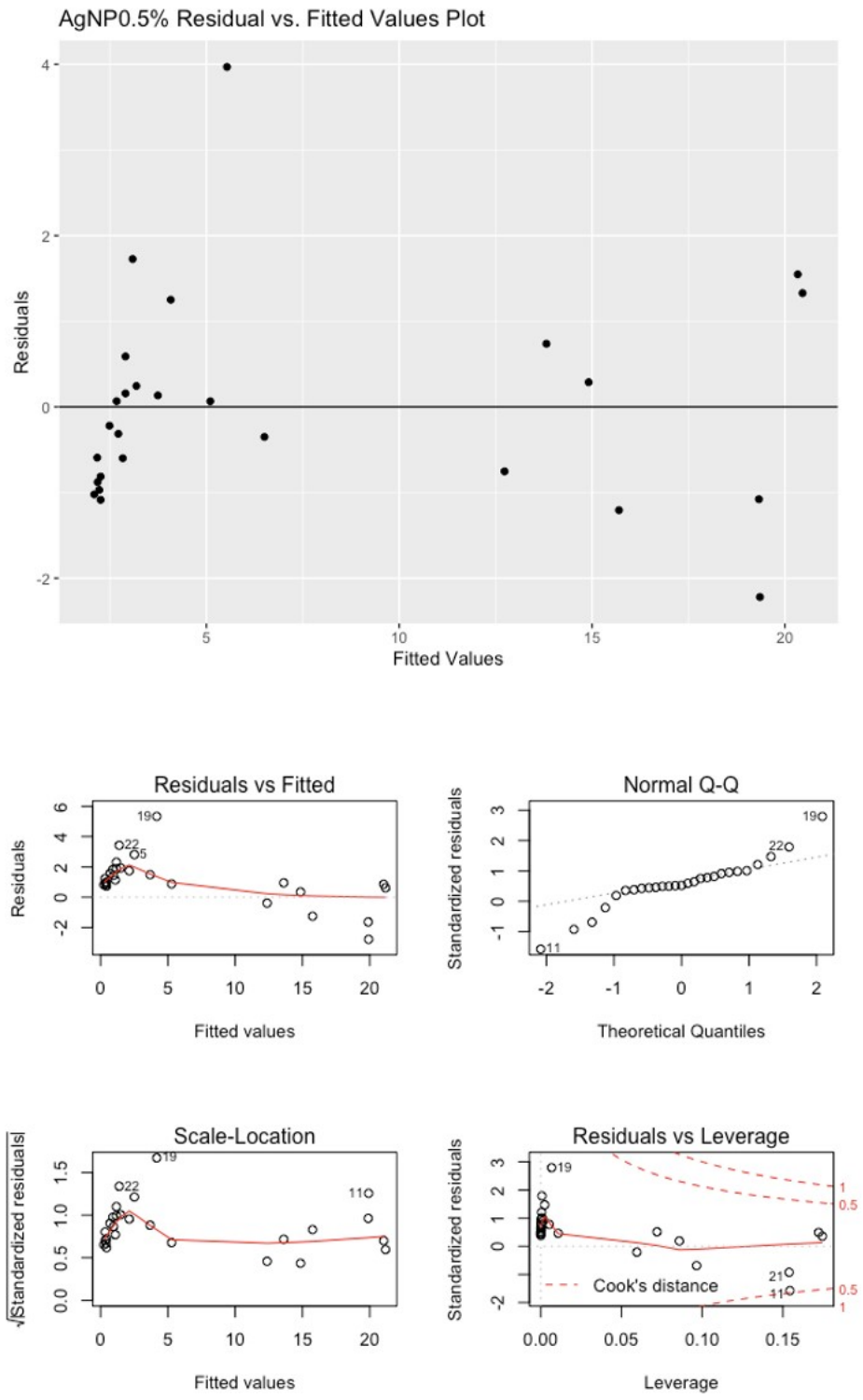

Figure S3: AgNP 0.5% Statistical Tests with Residual Plot

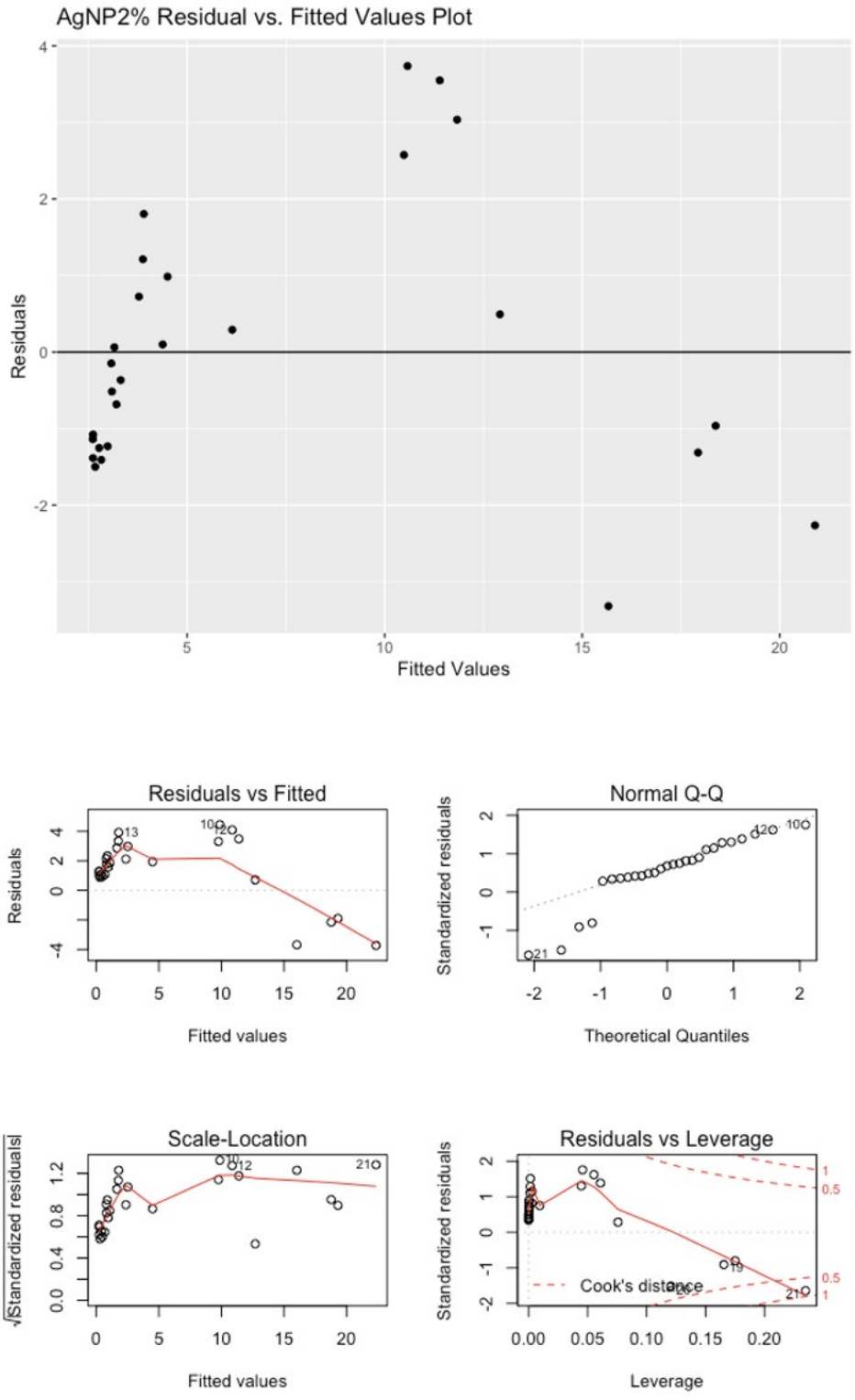

Figure S4: AgNP 2% Statistical Tests with Residual Plot

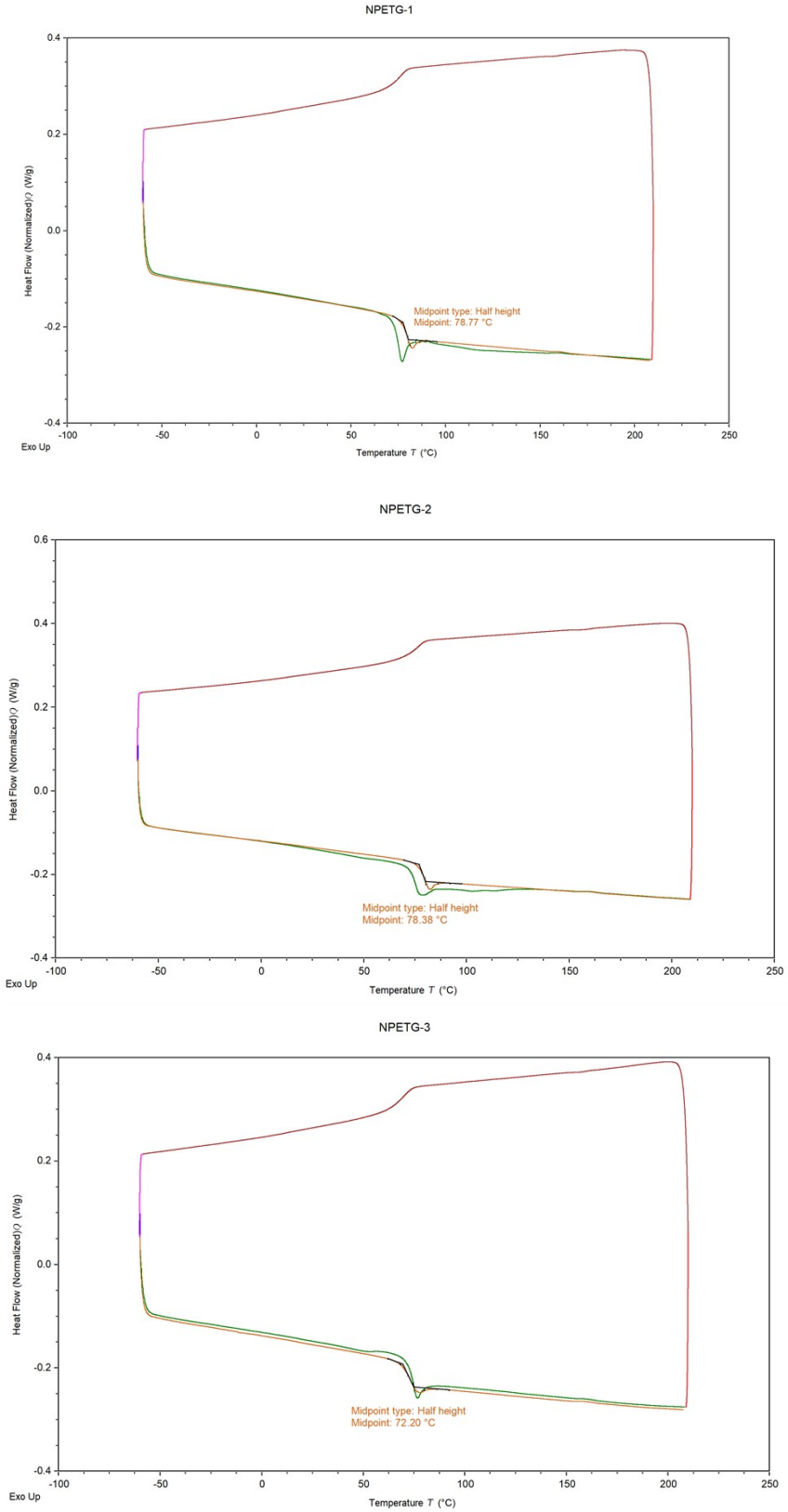

Figure S5) DSC Results for three PETG Replicates

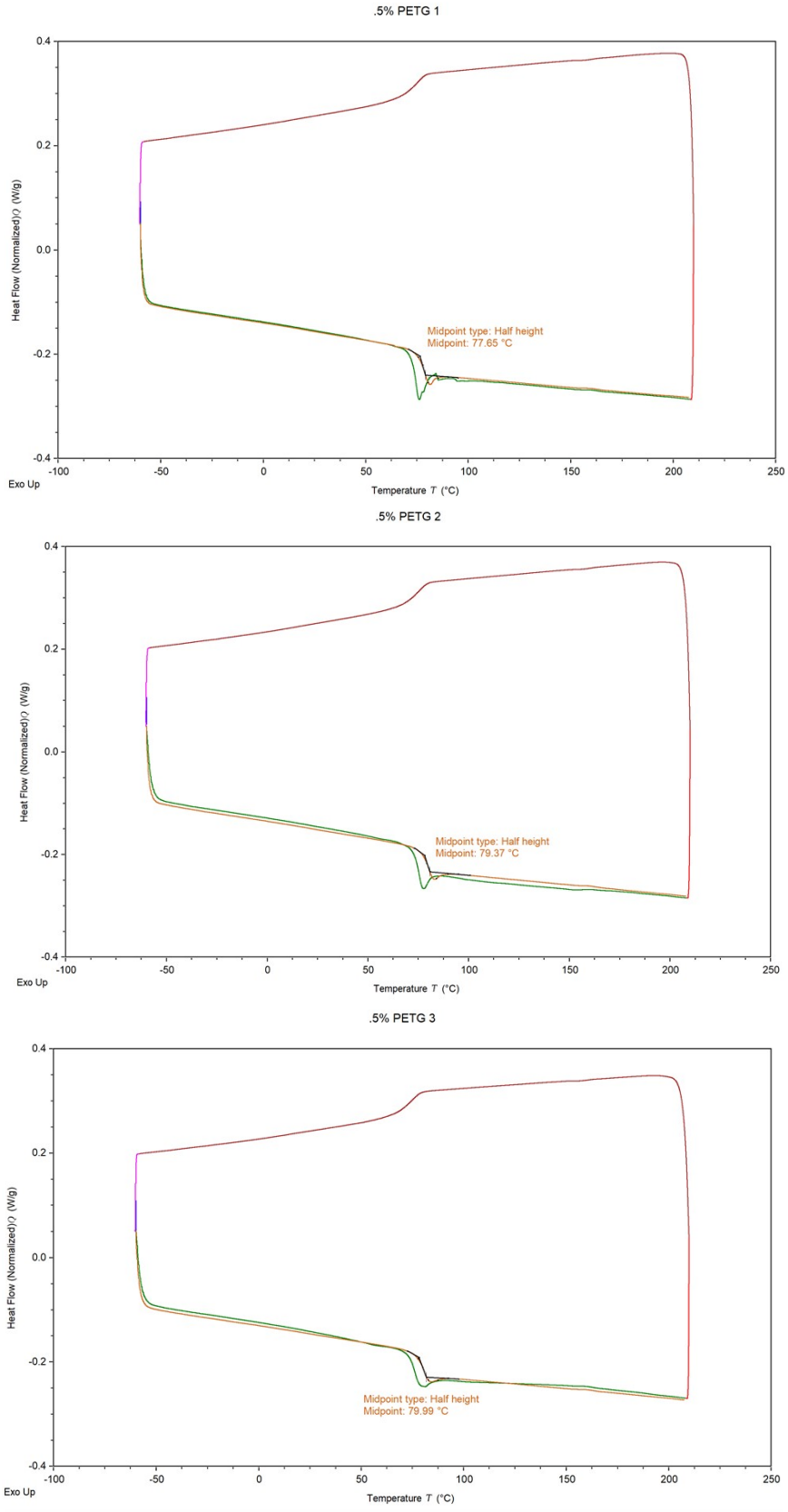

Figure S6) DSC Results for three 0.5%Ag Replicates

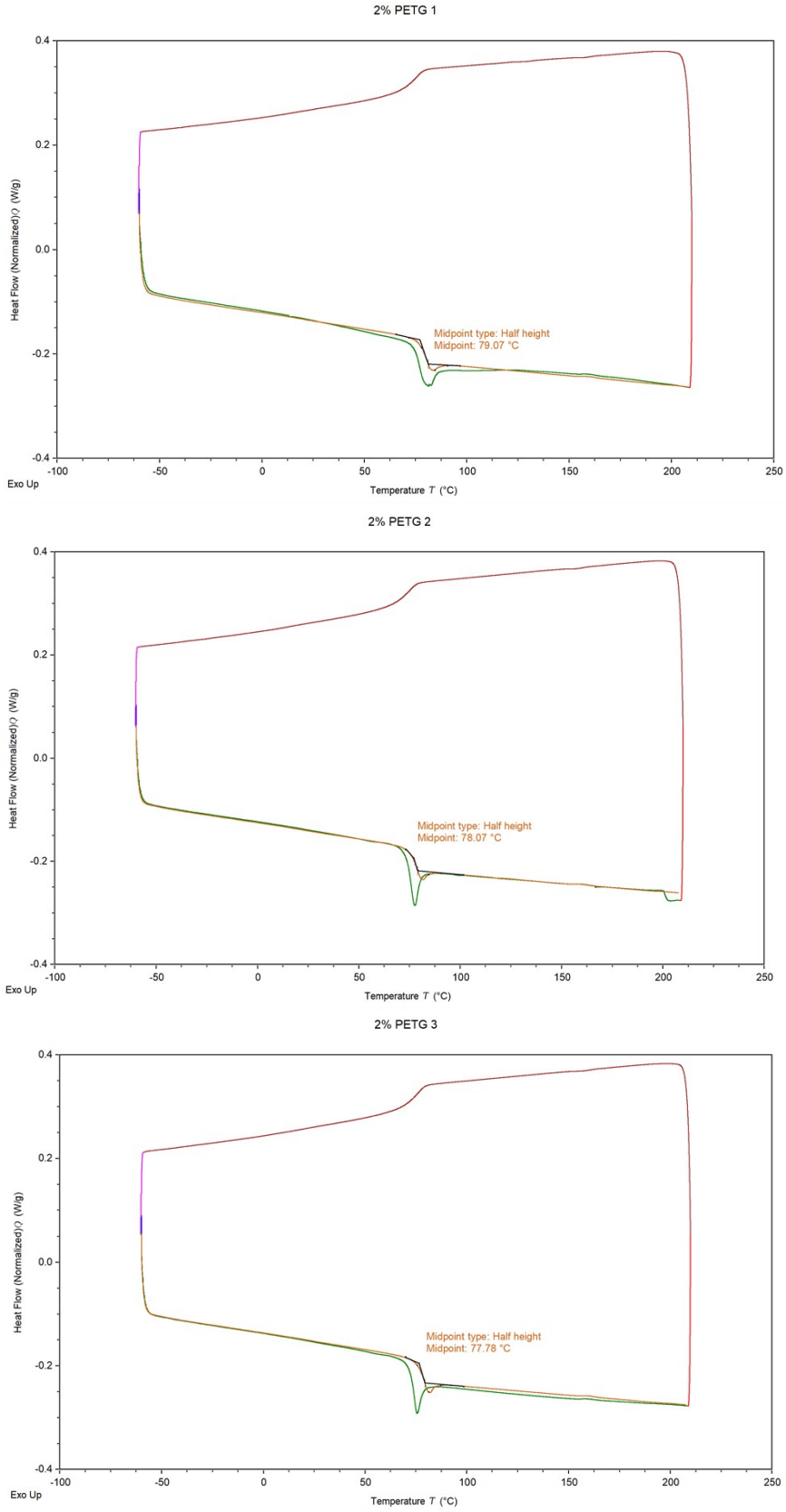

Figure S7) DSC Results for three 2%Ag Replicates

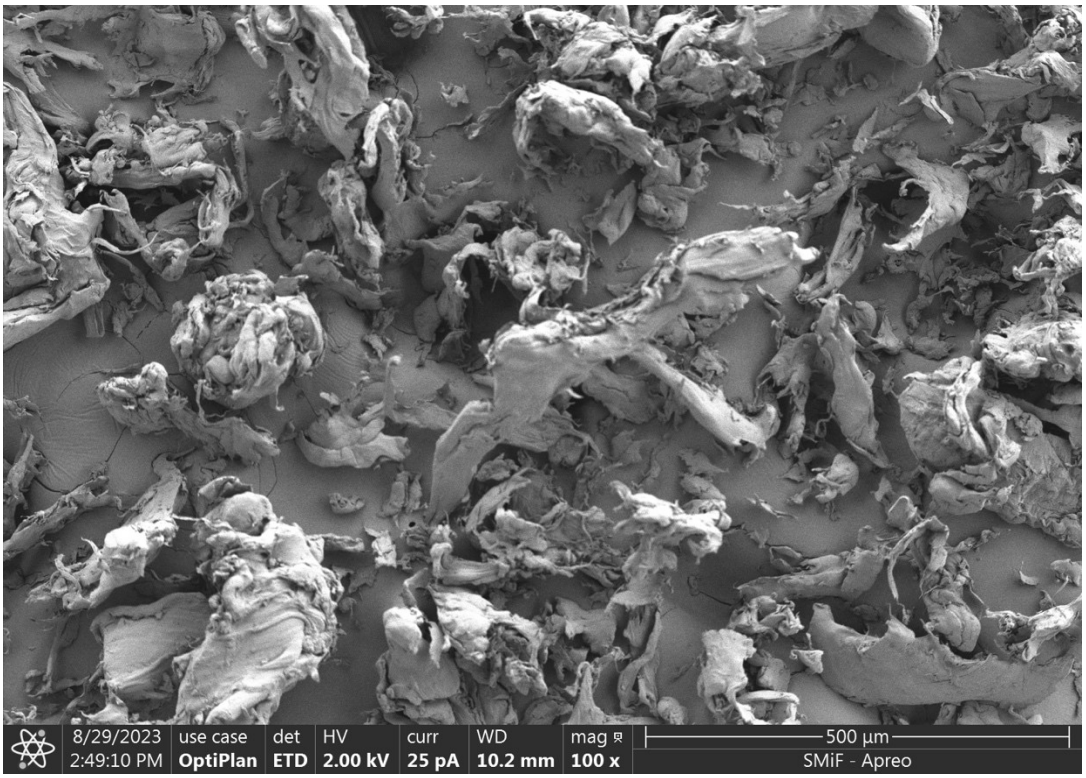

Figure S8: PETG SEM micrograph.

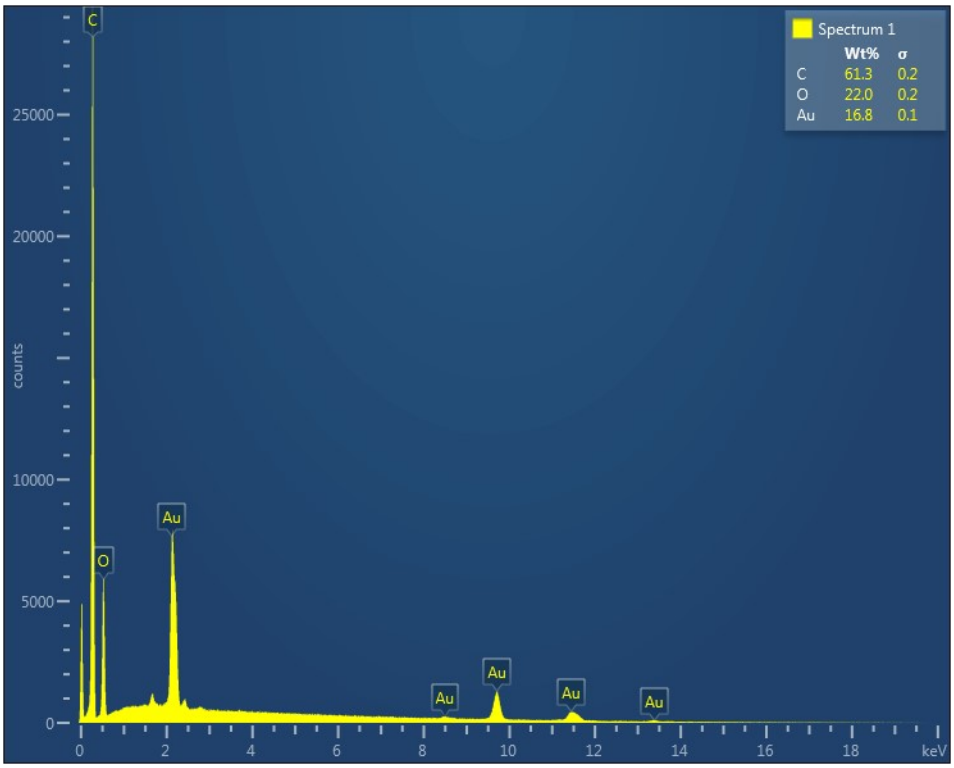

Figure S9: SEM EDS spectrum collected from a PETG particle. Au peaks are from the Au coating used to dissipate charging.

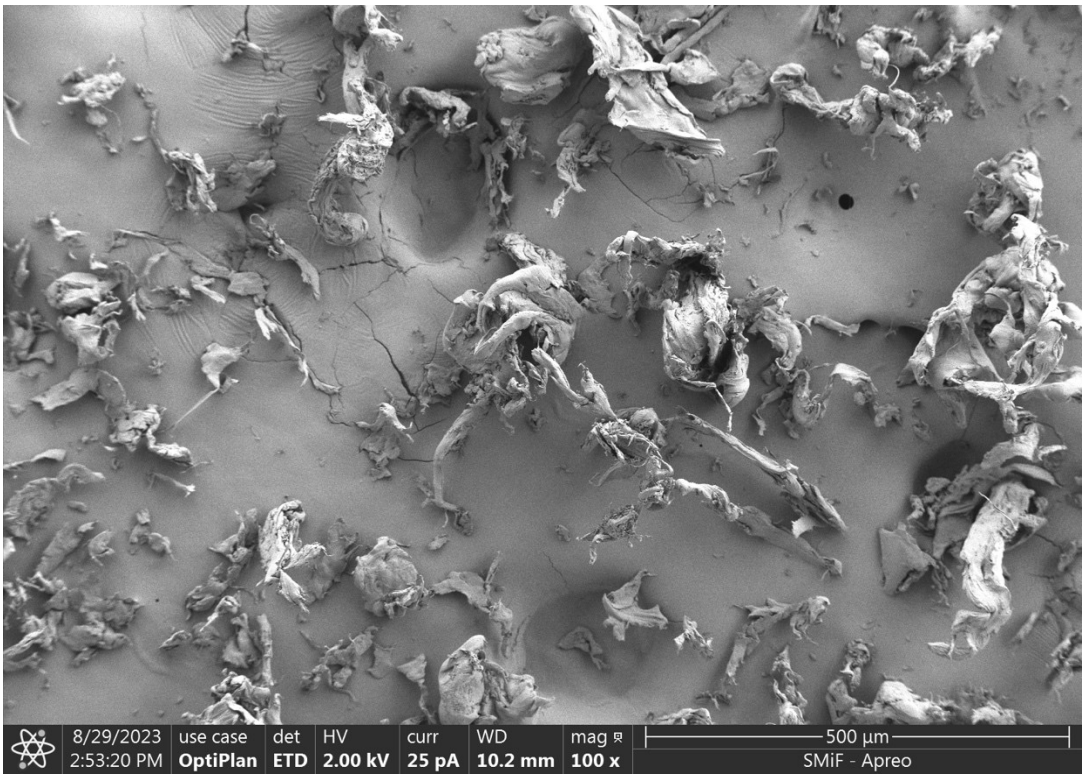

Figure S10: 0.5%Ag SEM micrograph.

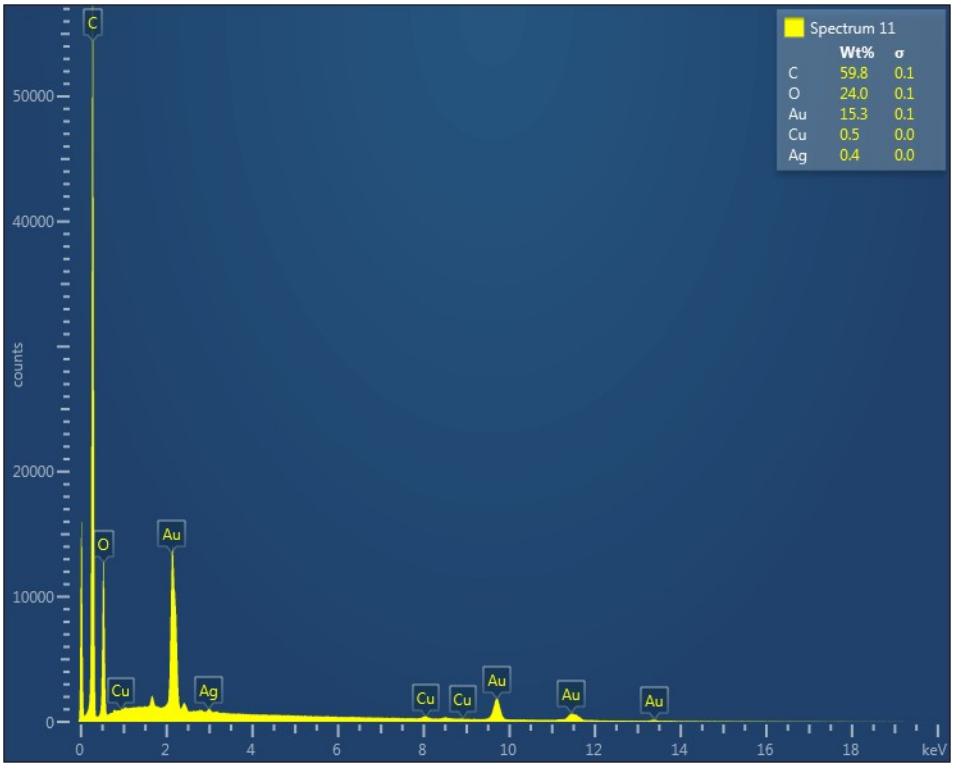

Figure S11: SEM EDS spectrum collected from a 0.5%Ag particle. Au peaks are from the Au coating used to dissipate charging.

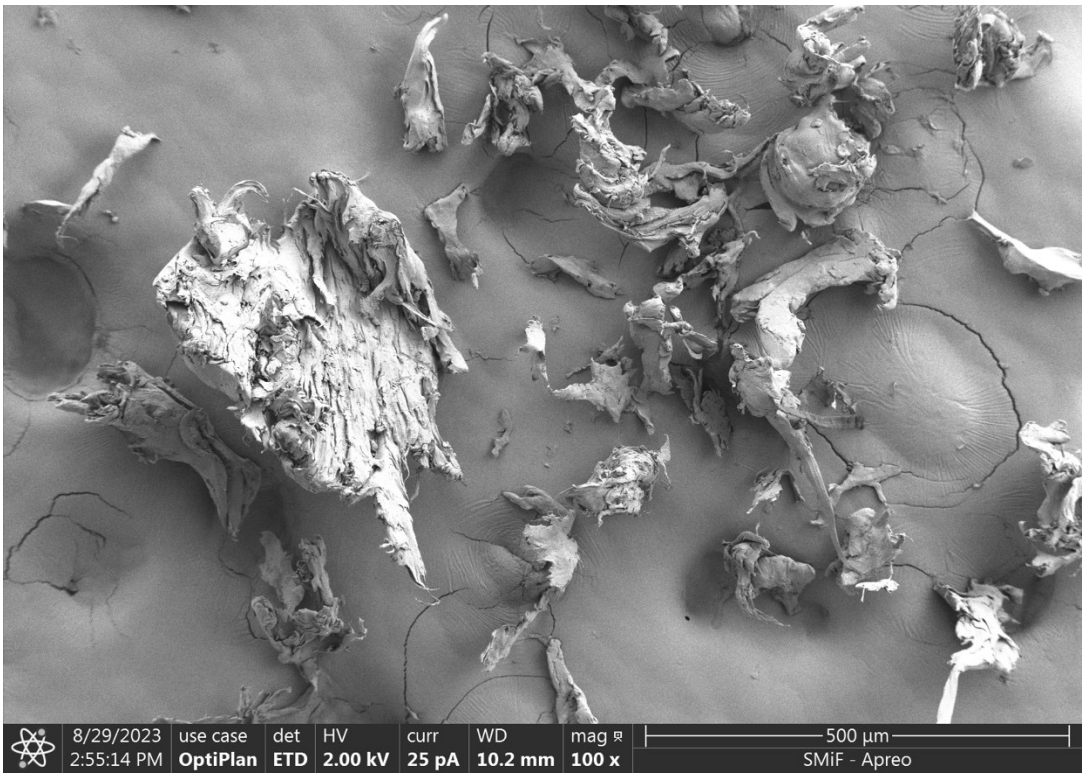

Figure S12: 2%Ag SEM micrograph.

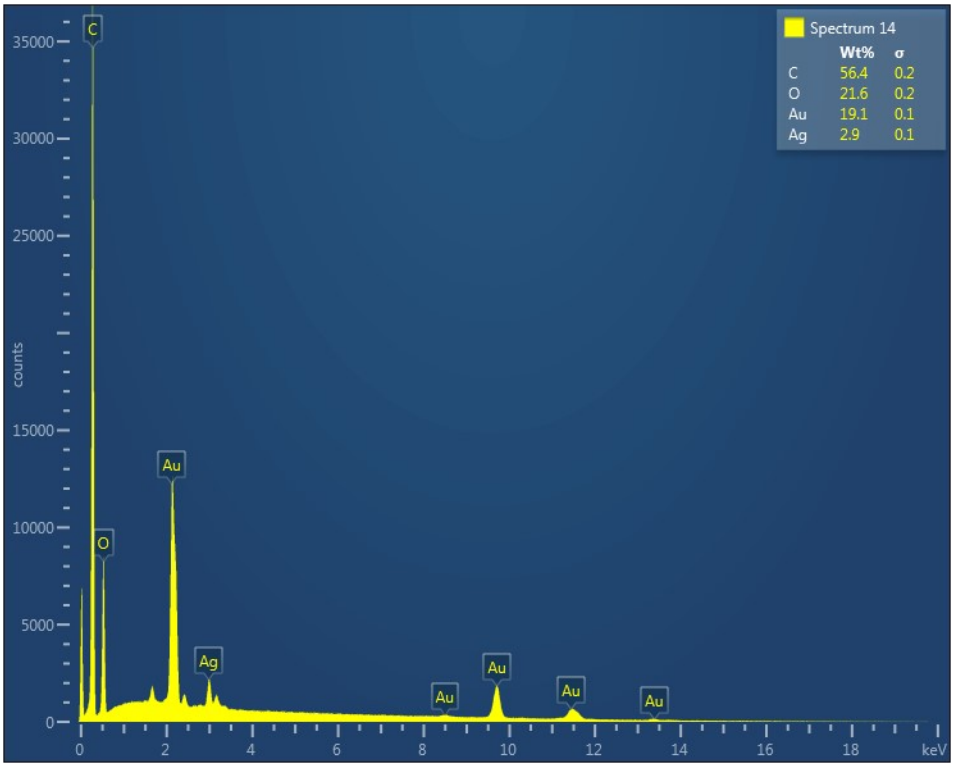

Figure S13: SEM EDS spectrum collected from a 2%Ag particle. Au peaks are from the Au coating used to dissipate charging.

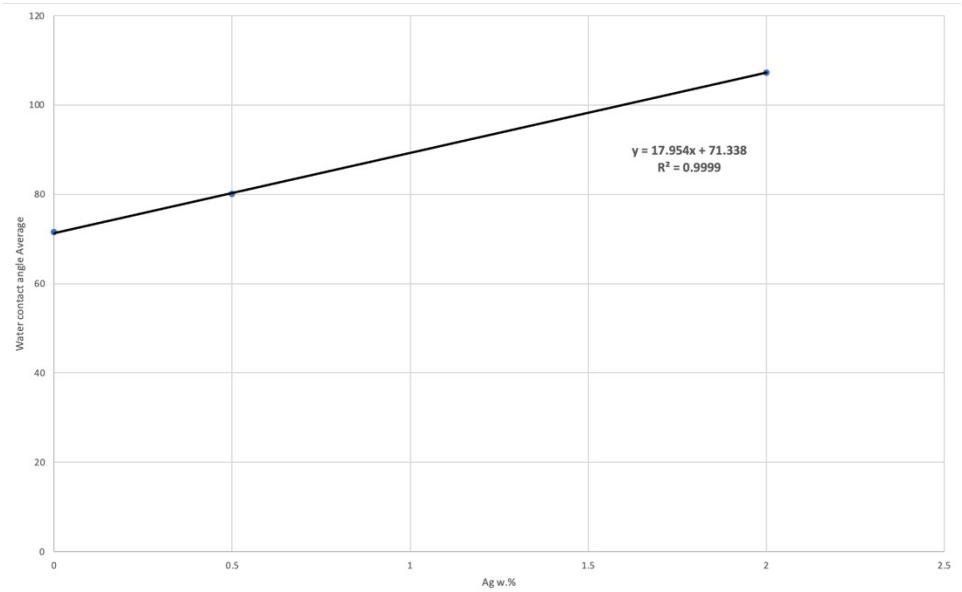

Figure S14: Linear relationship between contact angle and AgNP content in PETG

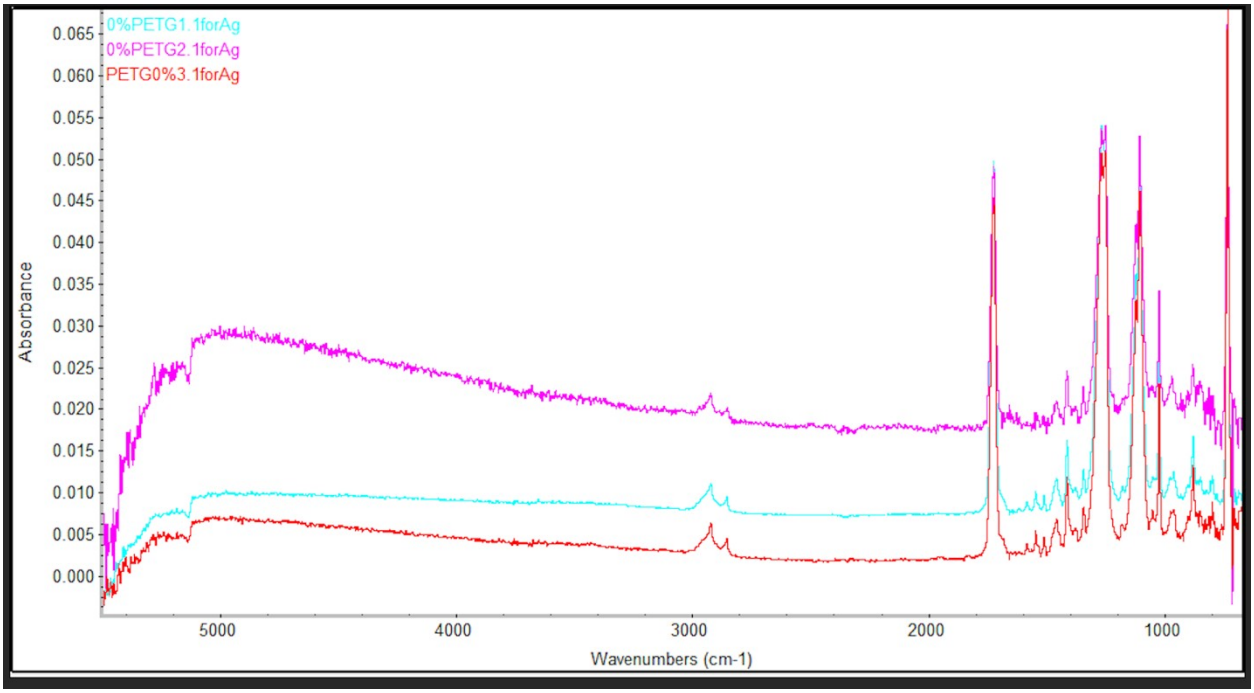

Figure S15: PETG FTIR spectra in triplicate

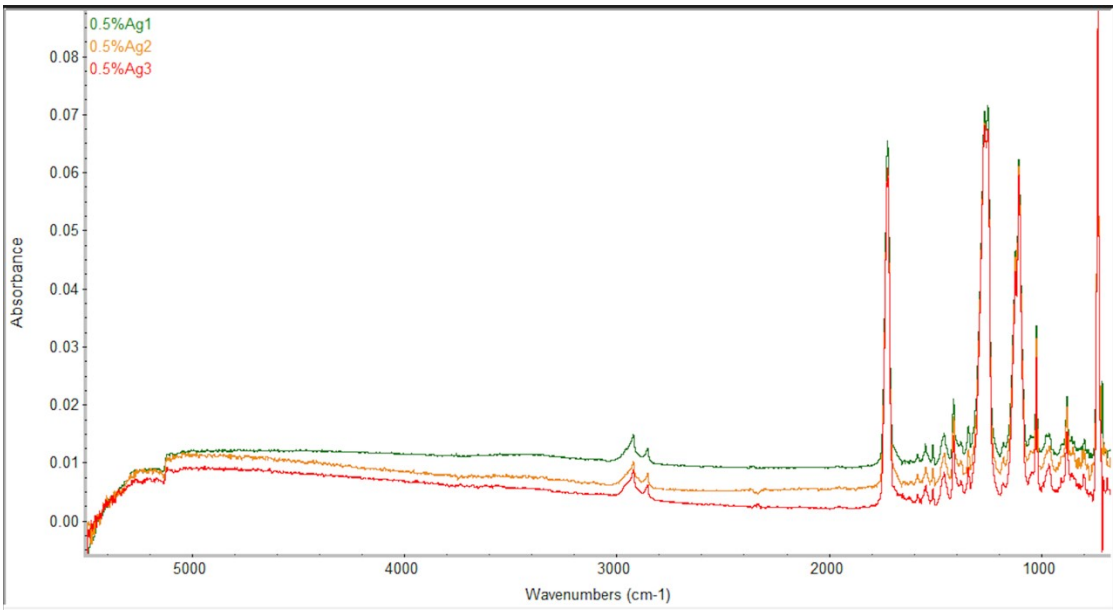

Figure S16: 0.5%Ag Composite FTIR spectra in triplicate

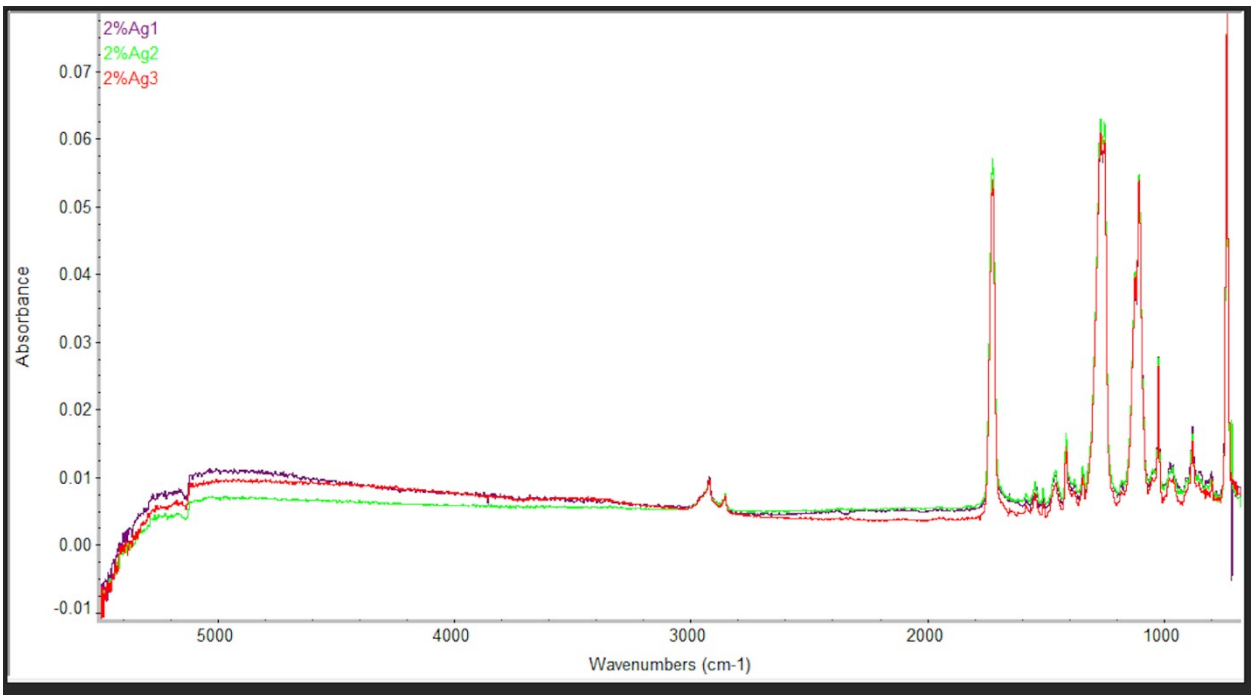

Figure S17: 2%Ag Conposite FTIR spectra in triplicate

Sanding

1. Using Power Consumption Data at 1-3 J/s from (Loredana et al., 2015)
2. Using Power Consumption ideal point at 300 J/s from (Luo et al. 2014)

Quantity and (units)	For PETG	For Ag0.5%	For Ag2%
Model fit * low power input (W)	$y = (0.0355x)*1 \pm 0.0140$	$y = (0.0433x) * 1 \pm 0.0296$	$y = (0.0341x) * 1 \pm 0.024$
Model fit * high power input (W)	$y = (0.1179x) * 300 \pm 0.1$	$y = (0.1014x) * 300 \pm 0.06$	$y = (0.0965x) * 300 \pm 0.1$
Abrasion rate(g/m^2/s) time (s) surface area (m^2)	$0.0355 \pm 0.014 - 35.37 \pm 0.1514$ g/m^2/s *3600 s and surface area of 0.00172 m^2	$0.0433 \pm 0.0296 - 30.42 \pm 0.0615$ g/m^2/s *3600 s and surface area of 0.00172 m^2	$0.0341 \pm 0.0248 - 28.95 \pm 44.07$ g/m^2/s *3600 s and surface area of 0.00172 m^2
Mass exposed to (g/hr)	$0.2198 \pm 0.0867 - 219.0 \pm 0.94$	$0.2681 \pm 0.1833 - 188.4 \pm 0.38$	$0.2111 \pm 0.1536 - 179.3 \pm 0.91$

Table S2. Calculations of Sanding using Power inputs

Chewing

1. Using molar force for baby jaw as 2.5 N from (Tadesse et al.)
2. Using average baby jaw length as 52.5 mm from (Schipper et al.)

$$\frac{2.5\ N\ \times\ 0.0525m}{0.75\ s\ chew\ time} = 0.175\ J/s$$

Quantity and (units)	For PETG	For Ag0.5%	For Ag2%
Model fit * power input (W)	$y = (0.0355x)* 0.175 \pm 0.0140$	$y = (0.0433x) * 0.175 \pm$	$y = (0.0341x) * 0.175 \pm$
Abrasion rate(g/m^2/s) time (s) surface area (m^2)	0.0062 ± 0.0025 g/m^2/s *60 s and surface area of 0.00172 m^2	0.0076 ± 0.0052 g/m^2/s *60 s and surface area of 0.00172 m^2	0.006 ± 0.0043 g/m^2/s *60 s and surface area of 0.00172 m^2
Mass exposed to (mg/min)	0.6411 ± 0.2528	0.7820 ± 0.5346	0.6158 ± 0.4479

Table S3. Calculations of Chewing using Power inputs

$P = 3.162 \times 10^{-11}\ W$ from Sipe et al. 2022

Quantity and (units)	For PETG	For Ag0.5%	For Ag2%
Model fit * power input (W)	$y = (0.0355x)*$ $3.162 \times 10^{-11} \pm 0.0140$	$y = (0.0433x\ ) * 3.162$	$y = (0.0341x\ ) * 3.162 \times$
Abrasion rate(g/m^2/s) time (s) surface area (m^2)	$1.12251 \times 10^{-13} \pm 0.014$ g/m^2/s *86400 s and surface area of 0.00172 m^2	$1.3691 \times 10^{-12} \pm 9.35$ g/m^2/s *86400 s and surface area of 0.00172 m^2	$1.0782 \times 10^{-12} \pm 7.841$ g/m^2/s *86400 s and surface area of 0.00172 m^2
Max mass released (g/day)	$1.6681 \times 10^{-11} \pm 6.5786$	$2.0347 \times 10^{-10} \pm 1.39$	$1.6024 \times 10^{-10} \pm 1.165$

Table S4. Calculations of Ocean Waves using Power inputs

P $\approx 2.5\ W$ from Benumof et al.

Quantity and (units)	For PETG	For Ag0.5%	For Ag2%
Model fit * power input (W)	$y = (0.0132e^{(0.8606 * 2.5)}) \pm 0.0051$	$y = (0.0433x\ ) * 2.5 \pm 0.$	$y = (0.0341x\ ) * 2.5 \pm 0.$
Abrasion rate(g/m^2/s) time (s) surface area (m^2)	0.1135 ± 0.0051 g/m^2/s *86400 s and surface area of 0.00172 m^2	0.1083 ± 0.074 g/m^2/s *86400 s and surface area of 0.00172 m^2	0.2325 ± 0.062 g/m^2/s *86400 s and surface area of 0.00172 m^2
Mass exposed to (g/day)	17 ± 1	16 ± 11	13 ± 9

Table S5. Calculations of Ocean Shoreline using Power inputs

$P = 0.034\ W$ from Sipe et al. 2022

Quantity and (units)	For PETG	For Ag0.5%	For Ag2%
Model fit * power	$y = (0.0355x)*$	$y = (0.0433x\ ) * 0.034 \pm$	$y = (0.093x\ ) * 0.034 \pm$

input (W)	0.0355 ± 0.01405		
Abrasion rate($g/m^2/s$) time (s) surface area (m^2)	0.0016 ± 0.0002 $g/m^2/s$ *86400 s and surface area of 0.00172 m^2	$0.0014 \pm 0.0010 g/m^2/s$ *86400 s and surface area of 0.00172 m^2	$0.0032 \pm 0.0008 g/m^2/s$ *86400 s and surface area of 0.00172 m^2
Mass exposed to (g/day)	0.24 ± 0.04	0.20 ± 0.14	0.47 ± 0.12

Table S6. Calculations of Rivers using Power inputs

Power (J/time)	abrasion rate (g/m^2/t)	Power (J/s)	Abrasion Rate (g/s*m^2)
2% 1	PETG	17.41426205	2.013482762
2% 1	PETG	13.40992113	1.324199849
2% 1	PETG	13.06192557	1.017420412
2% 1	PETG	4.479858561	0.246588535
2% 1	PETG	4.50517657	0.170864497
2% 1	PETG	1.758713274	0.070869933
2% 1	PETG	2.580478093	0.084461427
2% 1	PETG	1.520750698	0.043686945
2% 1	PETG	1.543182654	0.024270525
2% 2	PETG	14.3155166	1.029070264
2% 2	PETG	14.86853677	1.187314088
2% 2	PETG	14.94432068	1.131977291
2% 2	PETG	5.708098839	0.186397633
2% 2	PETG	5.09382142	0.18348517
2% 2	PETG	3.22136982	0.092227995
2% 2	PETG	2.933240099	0.082519785
2% 2	PETG	1.474224878	0.023299704
2% 2	PETG	1.174174485	0.031066272
2% 3	PETG	16.61807739	1.957175144
2% 3	PETG	12.34346342	1.670782948
2% 3	PETG	18.62823292	2.33094123
2% 3	PETG	6.432560479	0.468906545
2% 3	PETG	5.489168748	0.262121671
2% 3	PETG	2.953771878	0.112615236
2% 3	PETG	2.528615992	0.099023742
2% 3	PETG	1.23492214	0.024270525
2% 3	PETG	1.418693864	0.050482692
0.5% 1	PETG	15.20026892	1.433902623
0.5% 1	PETG	14.55420918	1.313520818
0.5% 1	PETG	11.97777516	1.194109835
0.5% 1	PETG	3.492237602	0.113586057
0.5% 1	PETG	5.328220441	0.242705251
0.5% 1	PETG	2.402953503	0.093198816
0.5% 1	PETG	2.267909239	0.06795747
0.5% 1	PETG	1.444154307	0.042716124
0.5% 1	PETG	1.252973011	0.03883284
0.5% 2	PETG	21.78658207	2.043578213
0.5% 2	PETG	17.13373371	1.922225588
0.5% 2	PETG	14.49246795	1.520305692
0.5% 2	PETG	6.154648548	0.509681027
0.5% 2	PETG	5.167389671	0.355320487
0.5% 2	PETG	2.232673583	0.105819489
0.5% 2	PETG	3.429372616	0.14465233
0.5% 2	PETG	1.577463821	0.033007914
0.5% 2	PETG	1.068267075	0.024270525
0.5% 3	PETG	9.503732083	0.402890717
0.5% 3	PETG	21.88199704	2.029986719
0.5% 3	PETG	18.24897693	1.919313125
0.5% 3	PETG	4.814213702	0.133973299
0.5% 3	PETG	3.875722278	0.205814053
0.5% 3	PETG	3.060306539	0.113586057
0.5% 3	PETG	2.740095638	0.088344711
0.5% 3	PETG	1.299928232	0.033978735
0.5% 3	PETG	1.172322549	0.042716124
1	PETG	17.46174759	0
2	PETG	23.14596374	0
3	PETG	5.432677698	0
4	PETG	6.044521261	0
5	PETG	8.273186445	0
6	PETG	20.75593769	0
A	PETG	10.34137913	0
B	PETG	12.14468368	0
C	PETG	13.83297927	0
D	PETG	8.687478398	0
E	PETG	6.530675901	0
F	PETG	2.806652269	0
G	PETG	5.256358817	0
H	PETG	4.1204751	0
I	PETG	10.42182065	0
J	PETG	15.3845198	0
K	PETG	5.58693847	0
L	PETG	0.852557555	0
M	PETG	0	0
X	PETG	17.90670506	0
Y	PETG	7.203693702	0
Z	PETG	9.182802639	0
Pure 1	PETG	23.45864717	2.183376438
Pure 1	PETG	23.9008818	3.110510497
Pure 1	PETG	18.35370082	2.525105431
Pure 1	PETG	4.258888005	0.499001996
Pure 1	PETG	3.725527982	0.331049962
Pure 1	PETG	2.36056078	0.114556878
Pure 1	PETG	2.039525893	0.06795747
Pure 1	PETG	0.420959453	0.041745303
Pure 1	PETG	0.767779147	0.024270525
Pure 2	PETG	11.51079548	0.442744306
		21.52703062	1.106860766
		53.20303244	4.870187369
		50.10532239	5.091559523
		27.14300113	1.770977225
		22.65297743	1.106860766
		27.94997826	2.656465838
		40.35029769	5.534303829
		0	0