

SUPPLEMENTARY INFORMATION

Assessment of Fine Particles Released During Paper Printing and Shredding Processes

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Table S1. ICP-MS individual sample results for printed and plain paper particle mixed media

	Blank	Printed 1	Printed 2	Printed 3	Plain 1	Plain 2	Plain 3
	($\mu\text{g/g}$)	($\mu\text{g/g}$)	($\mu\text{g/g}$)	($\mu\text{g/g}$)	($\mu\text{g/g}$)	($\mu\text{g/g}$)	($\mu\text{g/g}$)
Li	0	1.02	2.32	1.76	0.425	2.1	0
Be	0	0	0	0	0	0	0
B	13.3	0	0	0	20.7	0	0
Na	0	0	0	0	0	0	0
Mg	0	0	0	0	0	0	0
Al	16	42.6	33.6	32.5	140	311	269
Si	0	0	0	0	0	0	0
P	1480	4280	9280	8340	8270	7830	7440
S	0	0	0	0	0	0	0
Cl	0	0	0	0	0	0	0
K	0	0	0	0	0	0	0
Ca	335	4920	6990	6950	8900	10100	9240
Sc	1.54	1.32	0.145	0.146	0.425	0.421	0
Ti	5.8	5.27	10.2	9.07	9.06	10.9	8.29
V	7.17	12.4	10.3	7.32	13.6	11.5	12.3
Cr	23	53.7	45.9	38.8	59	64.1	53.6
Mn	0	1.02	1.16	1.46	2.97	1.26	0.714
Fe	0	318	642	372	919	560	308
Co	0	0.293	1.02	0.732	1.84	1.26	0.857
Ni	0.683	0	0	0	132	0	0
Cu	3.59	5.85	3.2	5.27	47	8.83	4
Zn	40.6	0	0	11.1	41.2	75.8	4.57
Ga	0	0.146	0.291	0	0.283	0.421	0.143
Ge	0	0	0	0	0	0	0
As	4.44	10.2	9.44	8.93	9.34	7.99	8.71
Se	0	0	0	0	0	0	0
Br	6.32	44.2	106	195	159	178	117
Rb	0	0.585	0.581	0.146	0.708	0	0.429
Sr	3.24	8.49	9.59	10.4	11.6	12.2	10.6
Y	0.171	0	0.145	0	0	0.14	0
Zr	0.512	0	0	0	0.283	0.421	0
Nb	9.39	3.66	0.581	1.17	0.425	0.701	1.71
Mo	0	0.293	0	0.439	1.27	0.981	0.571
Ru	0	0	0	0	0	0	0
Rh	0	0.146	0	0.293	0	1.12	0
Pd	0	0	0	0	0	0	0
Ag	0.171	0	0	0	0	0	0
Cd	0	0	0	0	0	0	0
In	0	0	0.145	0	0	0.14	0
Sn	1.02	0	0	0	0	0	0
Sb	0.512	0	0	0	0	0.28	0.143
Te	0	0	0	0	0	0	0

I	0	0	0	0	0	22.6	0
Cs	0.171	0	0.726	0	0.142	0	0
Ba	0	2.63	4.36	4.54	8.49	7.29	6.43
La	0.171	0	0	0	0	0	0
Ce	0	0	0	0	0	0.14	0
Pr	0	0	0	0	0	0	0
Nd	0.171	0	0	0	0	0	0
Sm	0	0	0	0	0	0	0
Eu	0	0	0	0	0	0	0
Gd	0	0	0	0	0	0	0
Tb	0	0	0.145	0	0	0	0
Dy	0	0	0	0	0	0	0
Ho	3.59	0.732	5.38	0	0.708	0.701	0
Er	0	0	0	0	0	0	0
Tm	7.17	0	7.55	0	0	0	0
Yb	0	0	0	0	0	0	0
Lu	8.88	0.732	6.83	1.46	0.708	2.94	1.43
Hf	0.512	0.293	0	0.146	0	0	0.143
Ta	248	92.6	32	52.8	32.5	38.1	68
W	0.341	0	0	0	0	0	0
Re	0	0	0.436	0	0	0	0
Os	0	0	0	0	0	0	0
Ir	0	0.146	0	0.732	0	1.12	0
Pt	0	0	0	0	0	0	0
Au	0	0	0	0	0	0	0
Hg	0	0.293	0	0	0	0	0
Tl	0	0.146	0.436	0	0	0	0.143
Pb	0.341	0	0	0	3.82	0	0
Bi	0.171	0	0	0	0.142	0	0
Th	2.22	0.585	0.145	0.146	0	0	0.286
U	0.854	0	2.32	1.46	0	0	0.714

Table S2. Average particle concentrations of one-half fractions of each experiment during shredding only by particle size

		Average particle number concentration (# particles/ experiment period) on OPS															
Particle size (nm)		337	419	5	650	809	1,00	1,	1,5	1,94	2,42	3,0	3,7	4,6	5,8	7,242	9,016
				2			7	25	62	4	1	14	52	72	16		
				2			4										
Plai n 1	1st half	49	35	3	24	24	36	16	17	26	17	10	6	3	2	1	1
	2nd half	222	182	1	126	128	192	83	91	135	86	48	28	16	9	5	3
Plai n 2	1st half	127	59	4	29	28	40	17	19	27	17	10	6	3	2	1	1
	2nd half	211	144	1	90	90	131	56	62	89	58	32	19	12	6	4	2
Plai n 3	1st half	71	46	4	28	28	43	18	21	31	20	11	7	4	2	1	1
	2nd half	114	89	9	62	64	95	42	47	69	45	26	15	9	5	3	2
Pri nte d 1	1st half	49	34	3	20	19	27	12	13	19	13	7	4	3	1	1	1
	2nd half	202	158	1	94	89	127	53	58	82	51	28	17	10	5	3	2
Pri nte d 2	1st half	58	43	4	26	25	36	15	17	25	16	9	5	3	2	1	1
	2nd half	143	115	1	70	67	99	41	45	64	40	21	12	7	4	2	1
Pri nte d 3	1st half	96	69	7	47	45	72	31	34	52	33	19	11	7	4	2	1
	2nd half	270	223	2	157	158	252	11	122	182	118	65	39	23	12	7	4
		Average particle number concentration (# particles/ experiment period) on SMPS															

Particle size (nm)	11.5	15.4	20.5	27.4	36.5	48.7	64.9	86.6	115.5	154	205.4	273.8	365.2	
Plain 1	1st half	2,814	5,166	5,305	7,567	6,950	4,120	1,237	213	214	222	150	86	37
	2nd half	2,739	7,193	8,517	10,861	9,309	5,336	1,910	532	589	779	440	111	147
Plain 2	1st half	12,750	51,678	70,223	77,163	79,935	69,292	44,462	12,641	4,949	2,112	32	5,490	8,089
	2nd half	9,568	23,285	27,860	41,677	45,634	37,146	21,989	8,989	2,520	745	705	1,185	1,253
Plain 3	1st half	3,609	8,564	11,139	15,061	13,100	7,443	2,238	418	332	371	151	55	27
	2nd half	2,197	8,236	8,894	10,314	8,411	4,597	1,183	132	245	379	280	129	79
Printed 1	1st half	2,274	5,144	5,640	7,166	6,409	3,959	1,463	354	302	194	72	165	135
	2nd half	3,751	5,600	6,899	14,419	14,721	8,717	3,649	1,302	762	1,643	1,127	27	125
Printed 2	1st half	1,538	3,509	4,679	6,921	5,932	3,011	602	95	284	509	289	42	37
	2nd half	1,024	3,498	5,243	6,876	5,846	3,309	1,058	305	256	316	197	28	20
Printed 3	1st half	3,938	9,902	10,827	12,638	11,212	7,315	3,262	852	351	325	87	132	218
	2nd half	3,248	11,295	12,340	12,110	8,446	3,815	851	363	716	855	446	43	5

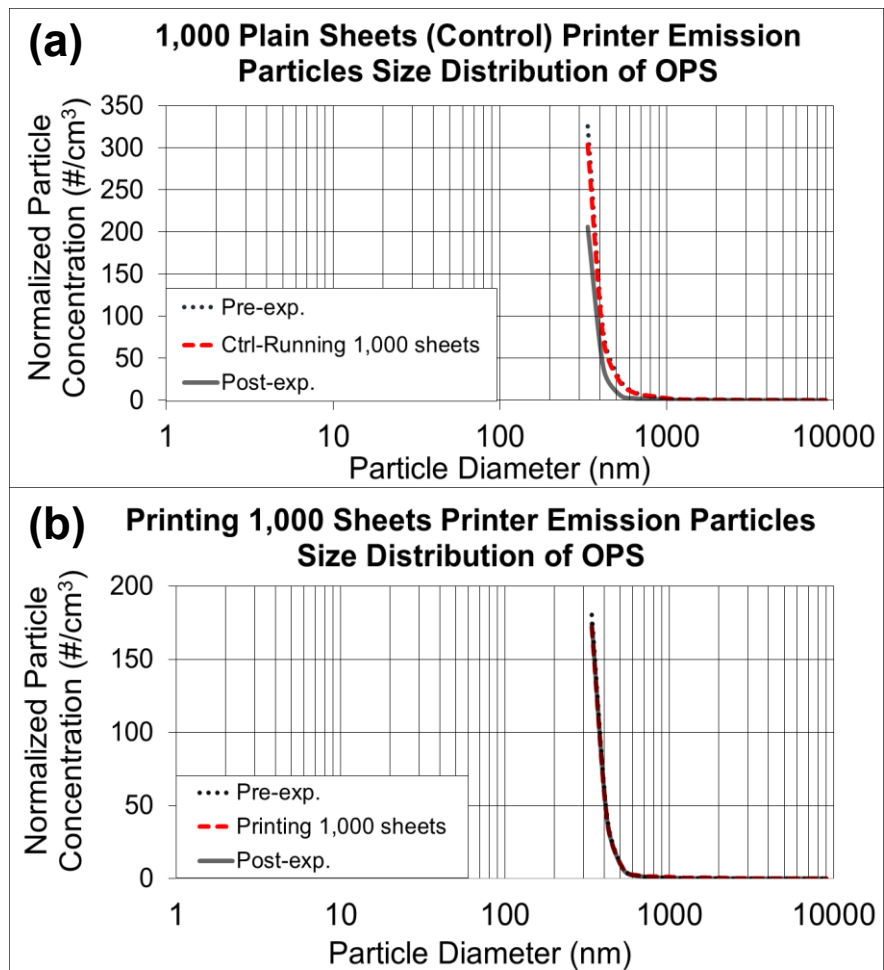


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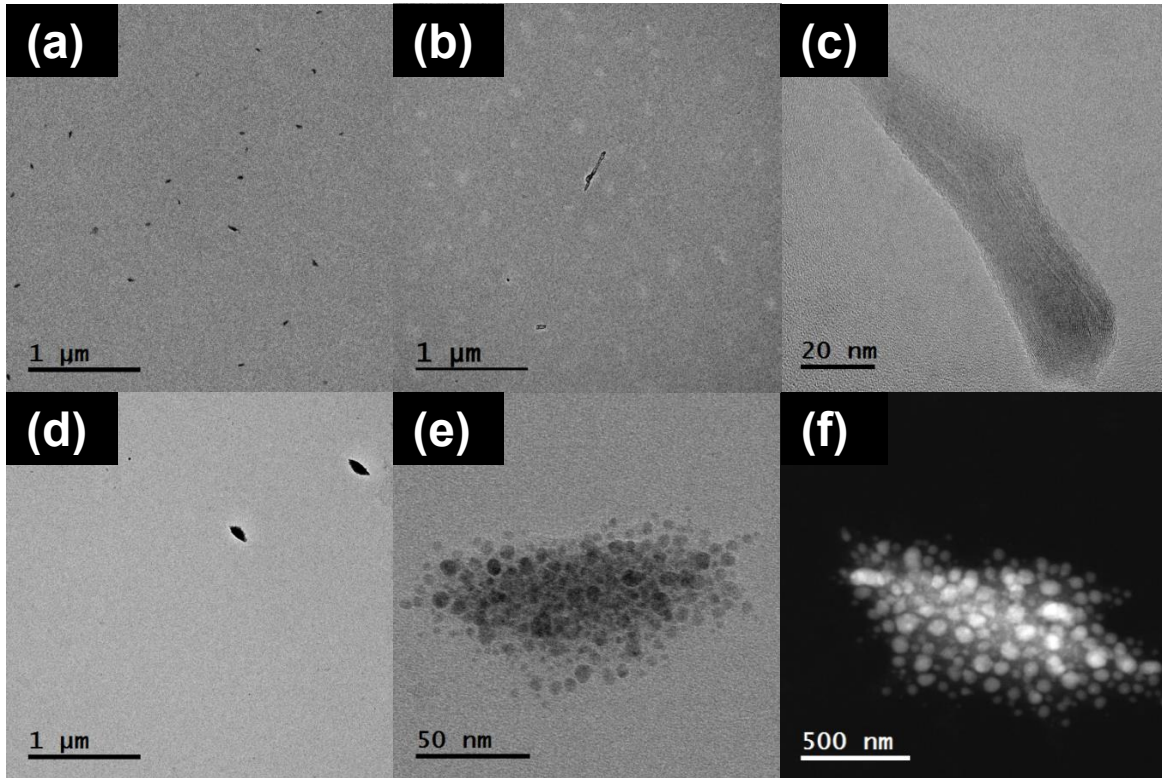


Figure S2. Microscopic analysis (TEM) of printer emitted particles collected on a TDS Cu grid. Various shapes of particles were observed.

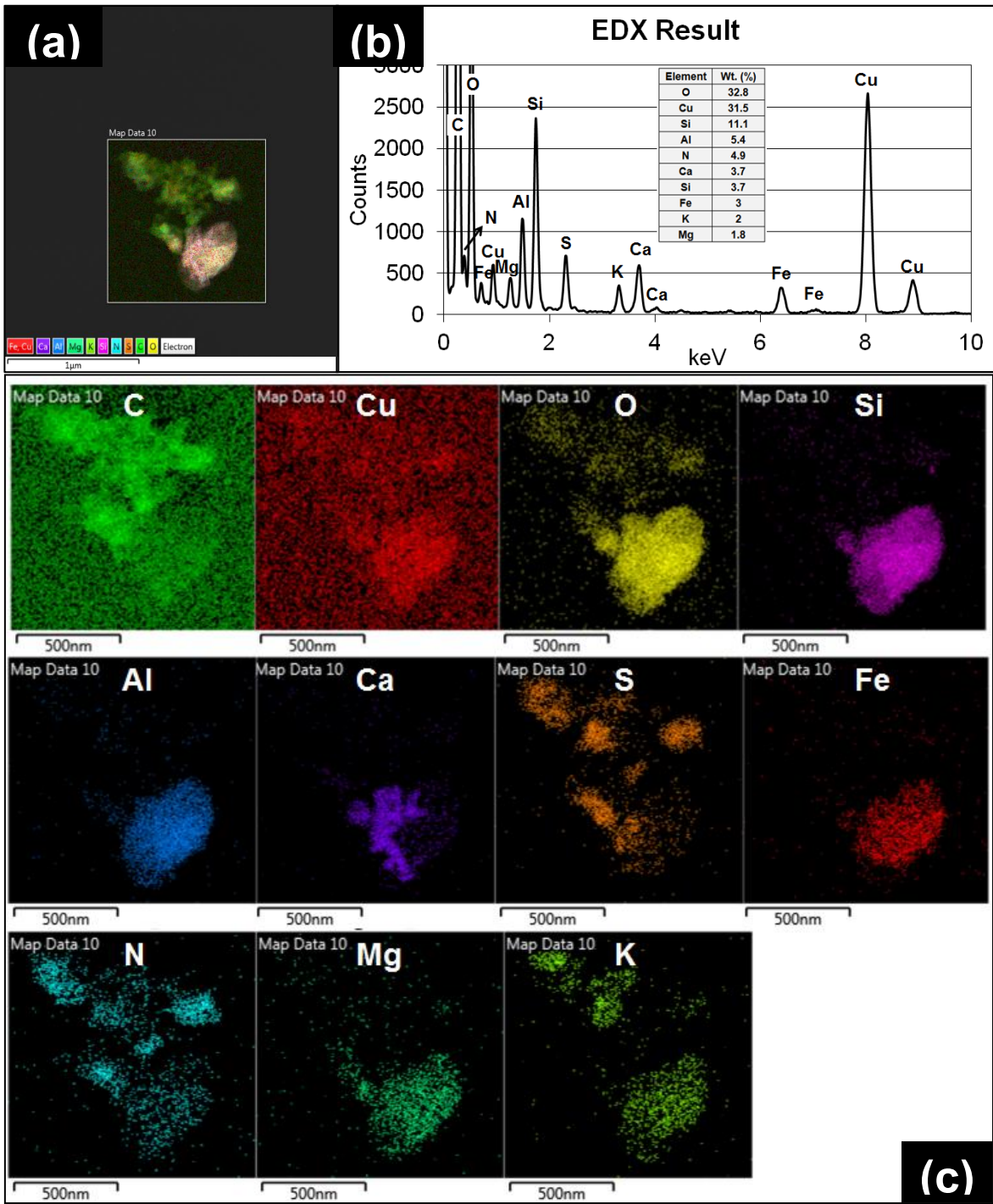


Figure S3. Printer released particle analysis via EDS, showing granules attached in one particle, as determined using TDS.

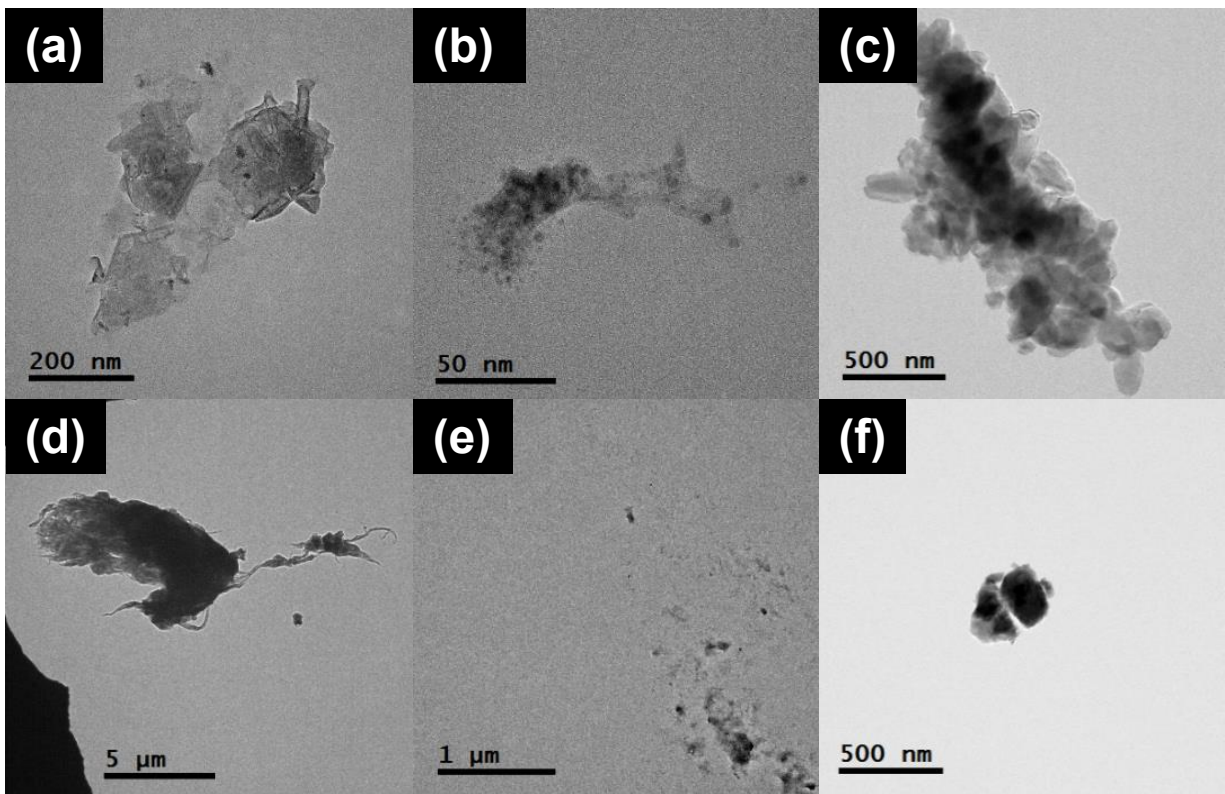


Figure S4. Paper particles observed from the shredding process. Various shapes of particles were observed through TEM.