

Characterization of Atmospheric Microplastics in Large Hailstones from Two Central Texas Supercell Thunderstorms

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Chicago

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Why Hail Water

- Opportunistic
- Hail melt water not well understood or studied
- Everyone is studying how or where hail forms

Hypothesis

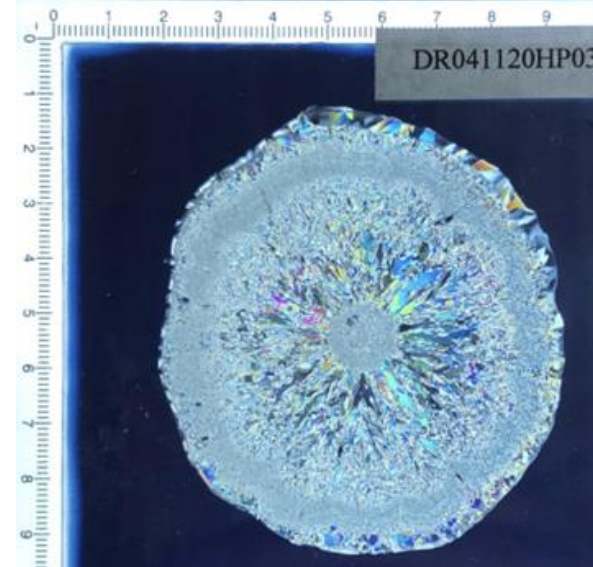
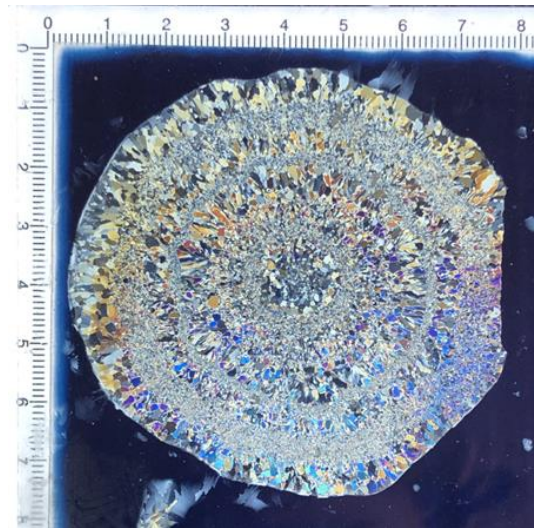
- Hail provides a proxy for atmospheric conditions at the time of a hail event.



Hondo Texas, 28 April 2021. photo: T. Nordstrand

The Question

- Can hail serve as a proxy for atmospheric environmental conditions?
- Do particulates accrete to hail like an “onion”.
- Can hail be preserved for an extended period of time allow are look into the past?



Thin sections cross polarized light,
T.E. Nordstrand

Methodology

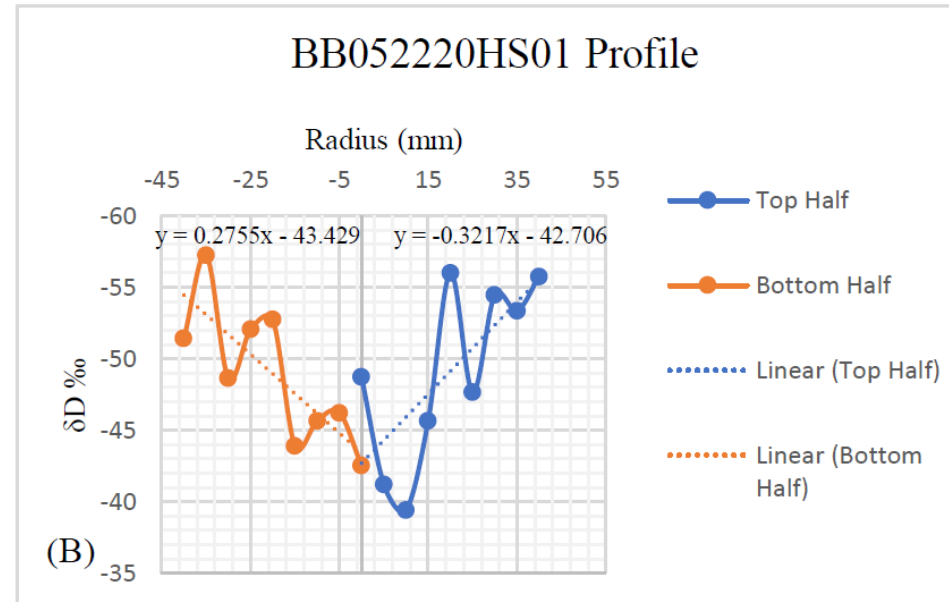
- Contamination – Yes of course, how much? Easy question – hard answer
- Hail collected off the ground by citizens
- Stored in double zip lock bags
- Rinsed with Ultra-pure water
 - Until I deem fit “very little, suspect literature on hail water analysis”
 - Can rinse until nothing left to ensure “zero” contamination
- Melt at room temp in clean mason jars sealed with silica paper
- Vacuum filtration through 0.2 μ glass filters
- Visually inspected
- Plastics analyzed Shimadzu AIM 9000 micro FTIR
- Shimadzu Library



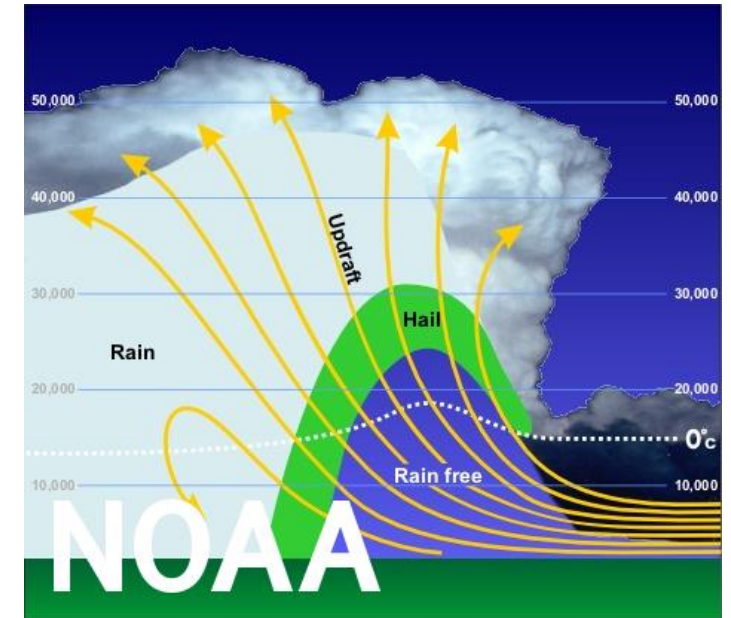
Sydney donating hailstones,
Burkburnett Texas, 22 May 2020,
photo by: T. E. Nordstrand

What can hail water can tell us?

- Hail trajectory
- Water composition



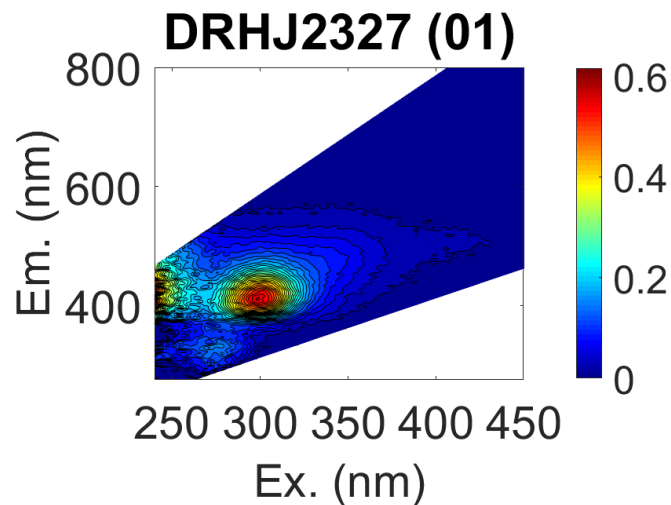
Nordstrand, T. E. (2021). Characterization of Large Hailstone Growth Using Stable Isotopes, The University of Texas at San Antonio. Figure 66. Burkburnett hailstone profiles based on δD .



[Thunderstorm Hazards - Hail | National Oceanic and Atmospheric Administration \(noaa.gov\)](https://www.noaa.gov/thunderstorm-hazards-hail)

What can hail water can tell us?

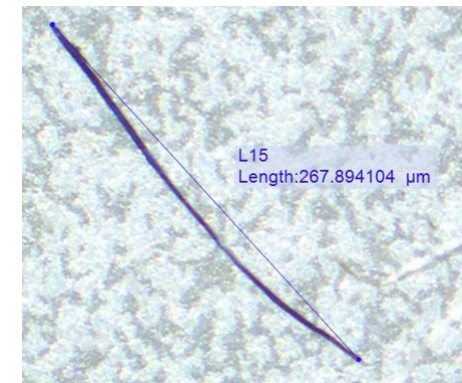
- Organic content
- Microplastics



Data derived from hailstone
DRHJ042220HJ23, Horiba Aqualog, T. E.
Nordstrand, 08/22

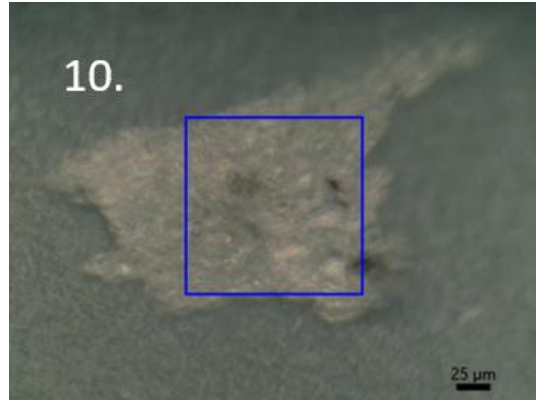


A stalk of corn encased in ice from Pampa, Texas, Nov. 16, 2015. (Johnny Goodson via Facebook)

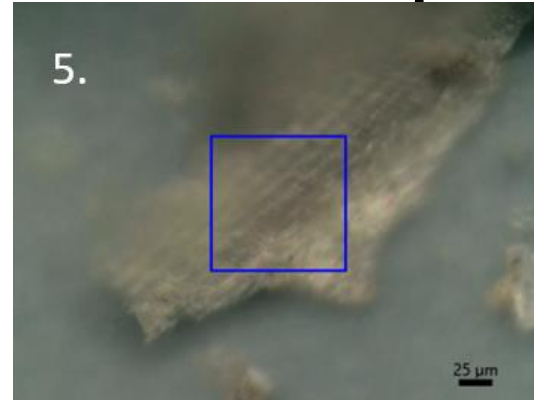


Initial findings, T.E. Nordstrand
& A. Felton 07/21

Results Top Microplastics



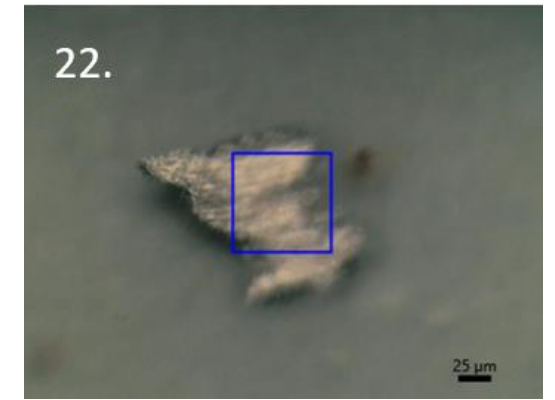
UV042821HA48, Sample 10, score 787
IRs Polymer2 LDPE
Low Density PolyethyleneFilm



DR041120HR01, Sample 5, score 729
T-Polymer2 PC Polycarbonate(PC)
Transmission(Microscope)



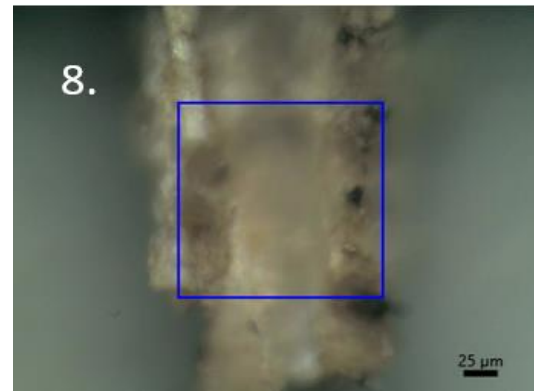
UV042821HA52, sample 17, score 720
T-Polymer2 T_PC2 Polycarbonate(PC)
Transmission(Microscope)



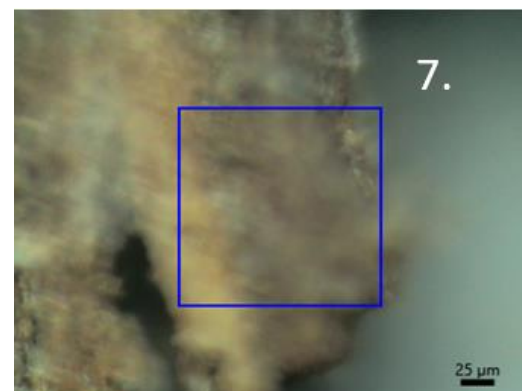
UV042821HA05, sample 22, score 718
ATR-Polymer2 D_PC
Polycarbonate(PC) DuraSamplIR-II



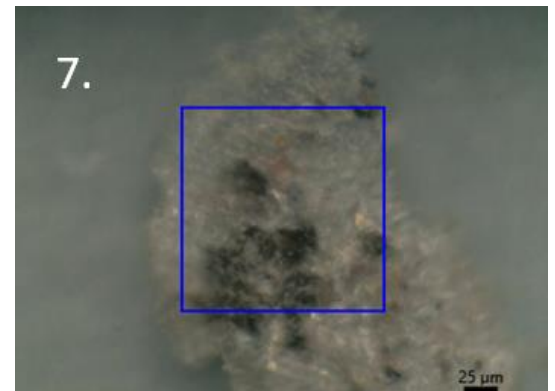
UV042821HA52, sample 3, score 710
T-Polymer2 PC Polycarbonate(PC)
Transmission(Microscope)



DR041120HE02, sample 8, score 708
ATR-Polymer2 D_PC
Polycarbonate(PC) DuraSamplIR-II



DR041120HR01, sample 7, score 703
T-Polymer2 PC Polycarbonate(PC)
Transmission(Microscope)



UV042821HA04, sample 7, score 702
ATR-Polymer2 D_PC
Polycarbonate(PC) DuraSamplIR-II

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Port Aransas Texas.



Xiangtao Jiang
Dr. Zhanfei Liu



The University of Texas at Austin
Marine Science Institute
College of Natural Sciences

Questions



Rihn Showpigs

2d · 🌐

This was in my kitchen floor. We are just...

Sabinal, Texas, Rihn Sowpigs 28 April 2021



Del Rio, Texas Hailstone, 28 April 2020, T.E. Nordstrand

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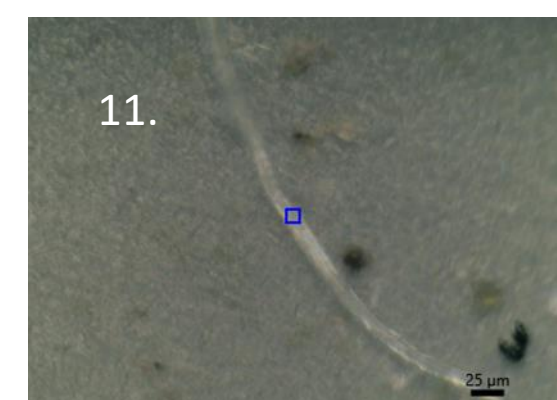
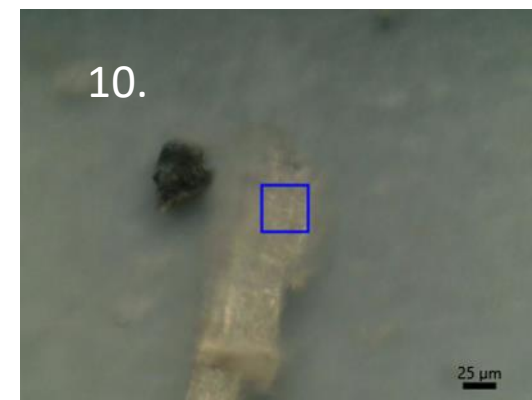
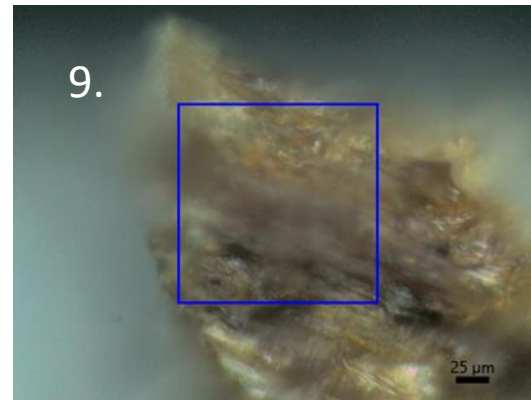
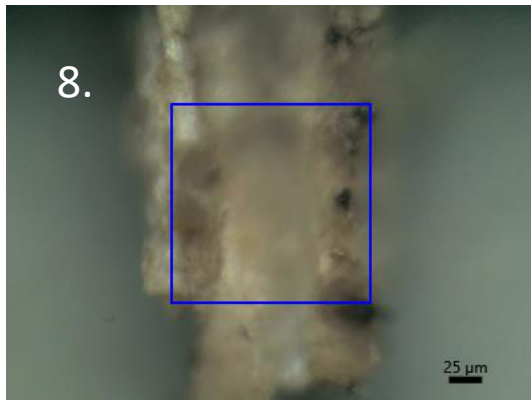
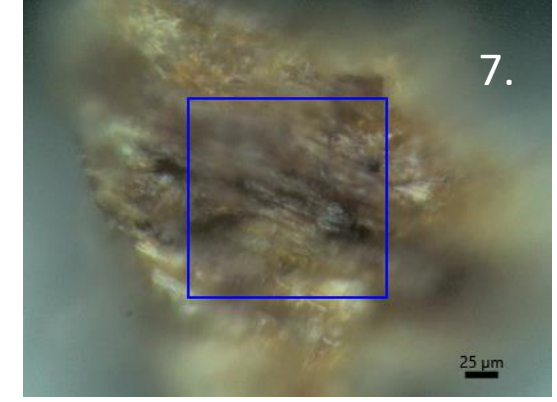
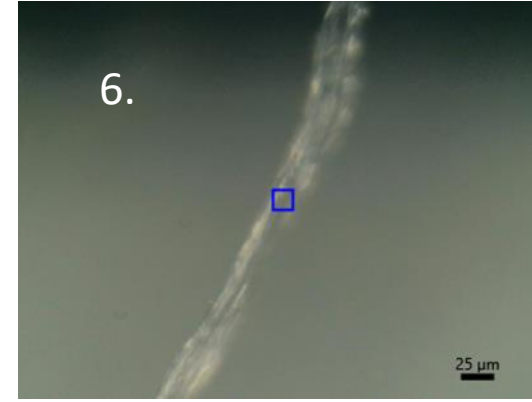
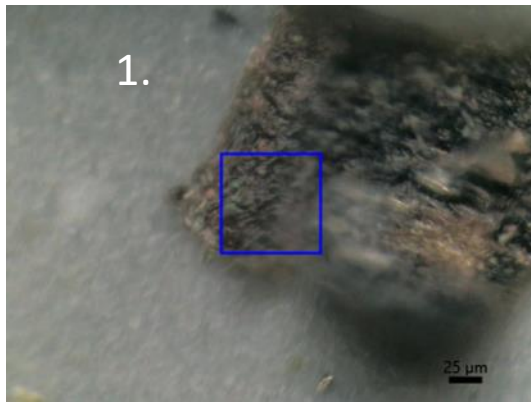
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Back Up Slides Microplastic Pictures and Excel Data

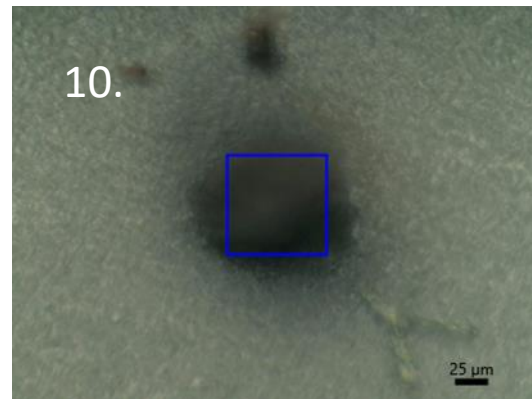
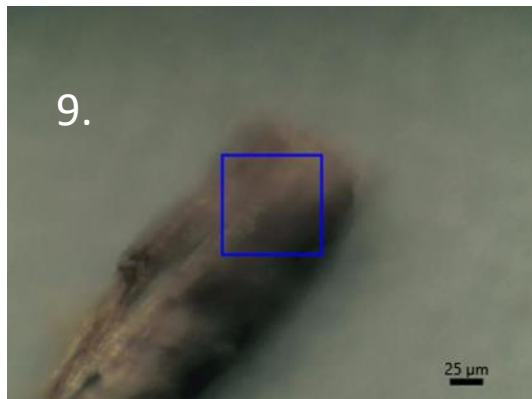
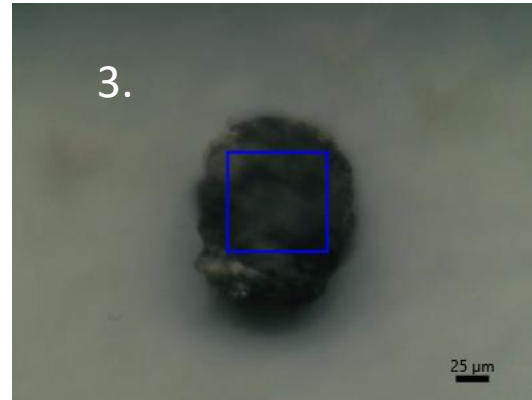
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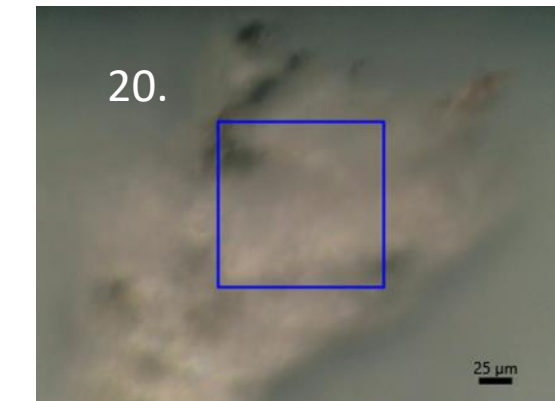
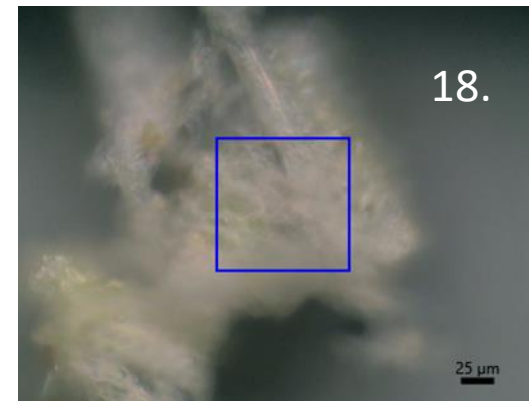
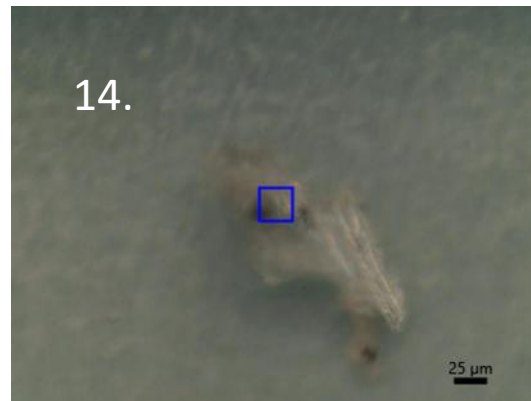
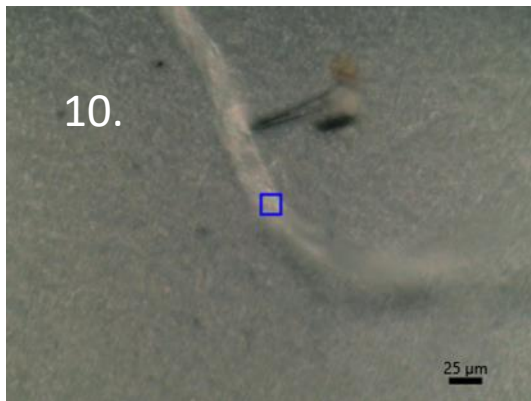
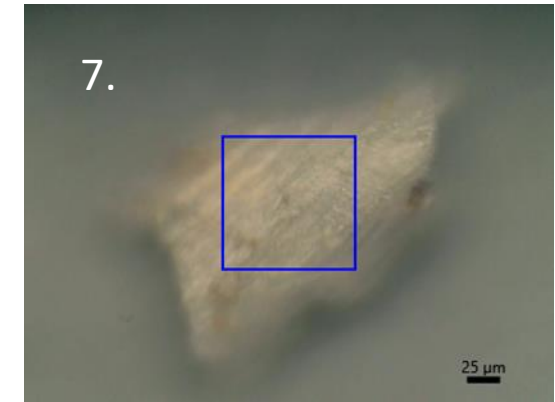
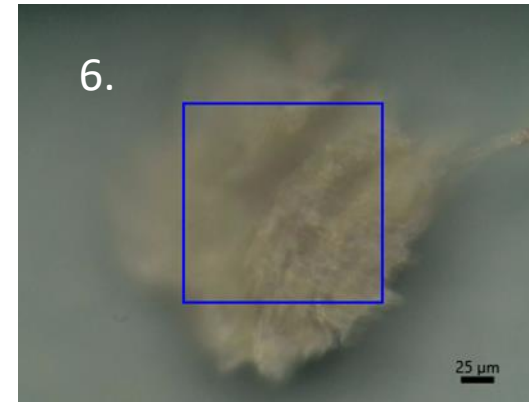
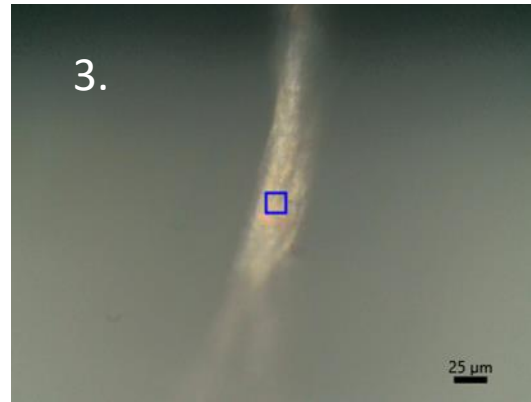
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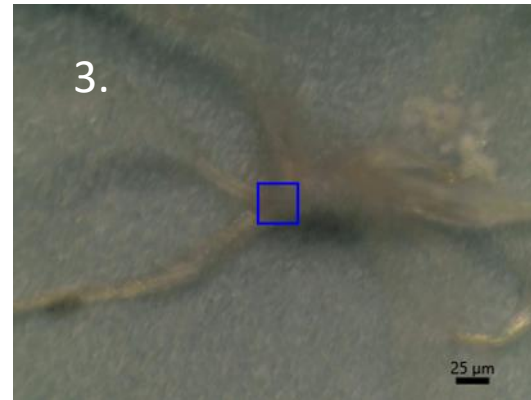
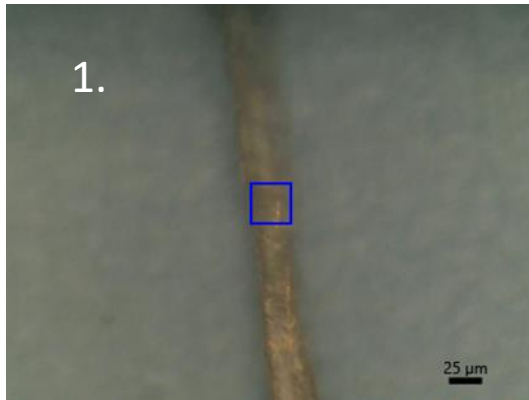
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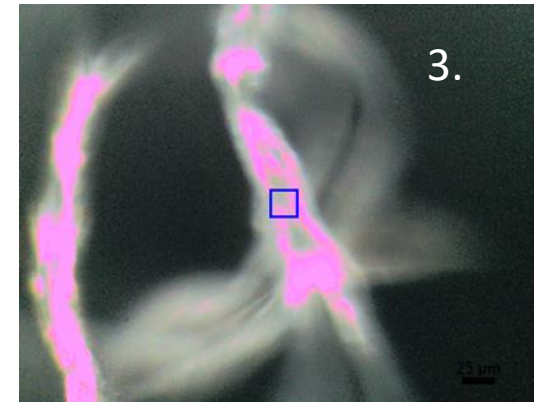
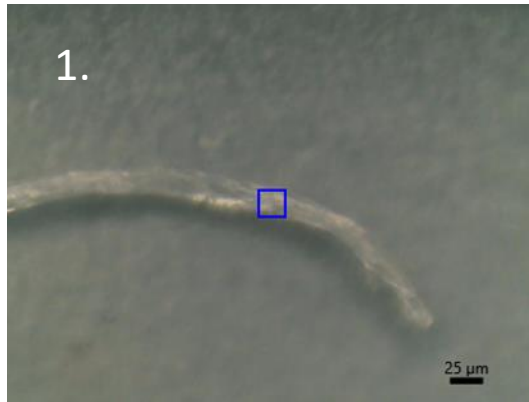
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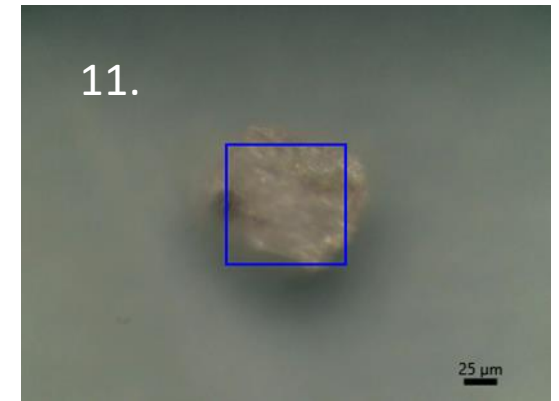
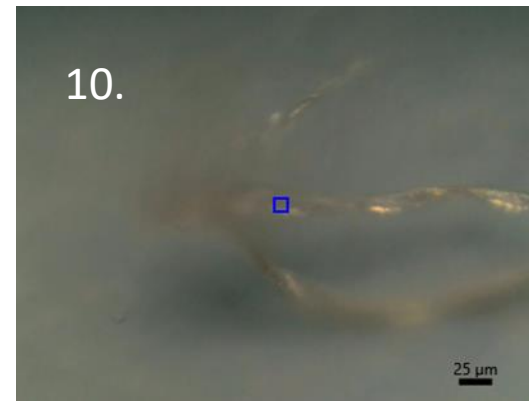
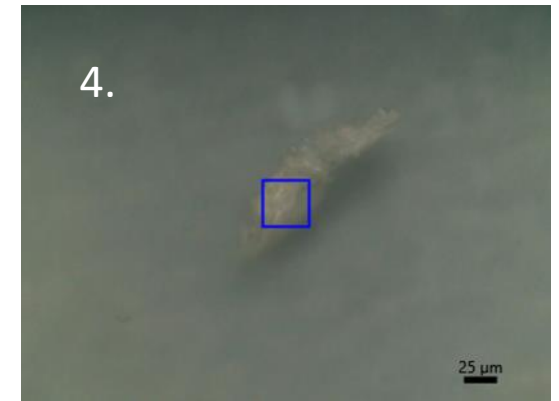
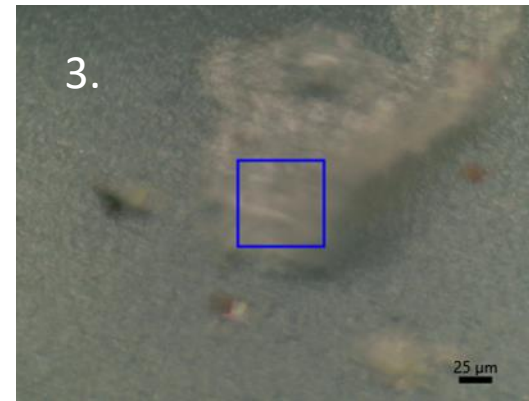
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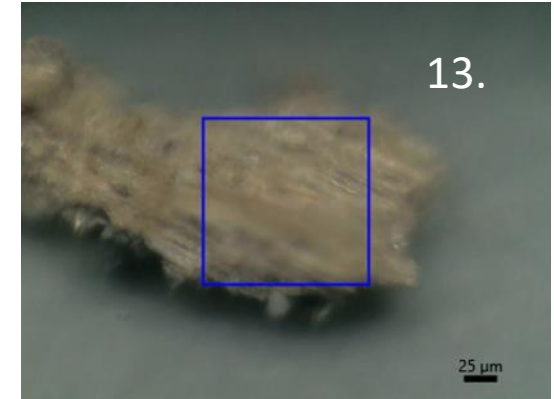
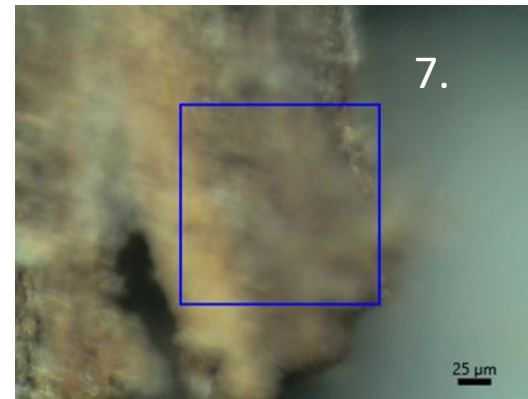
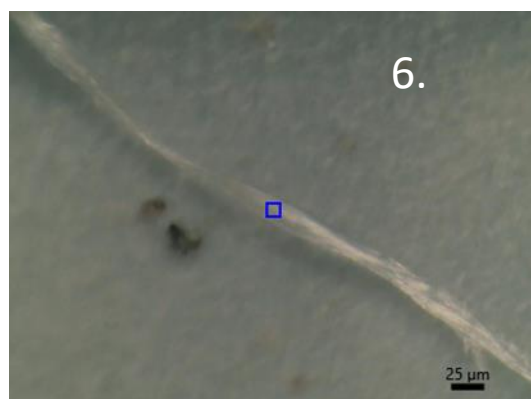
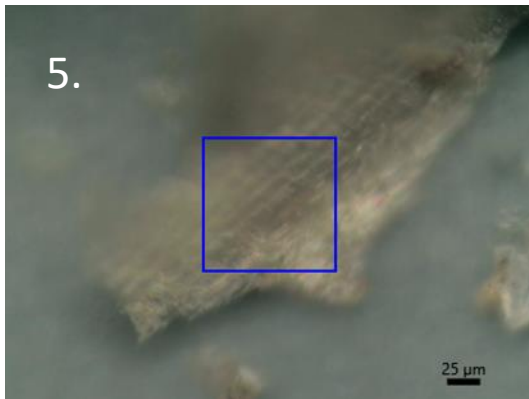
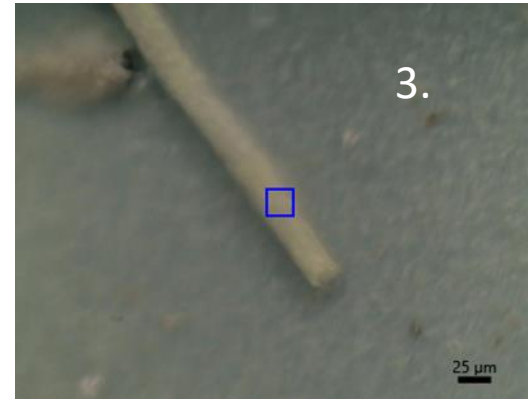
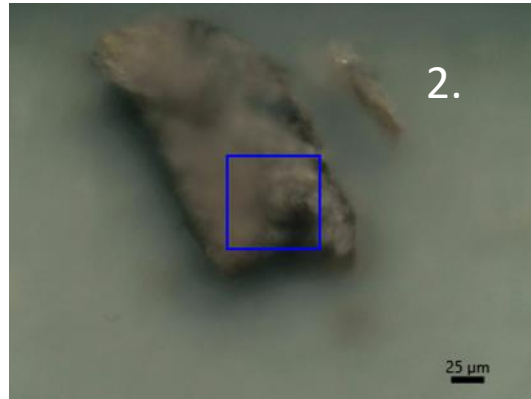
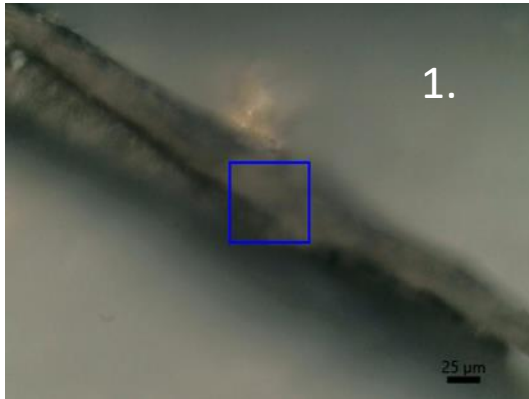
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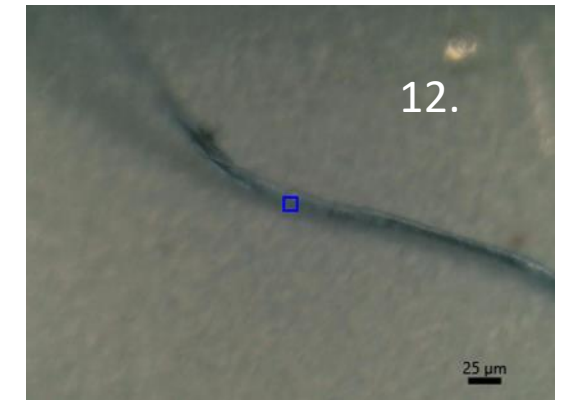
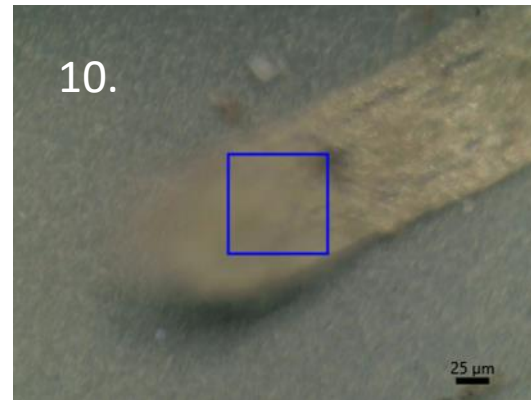
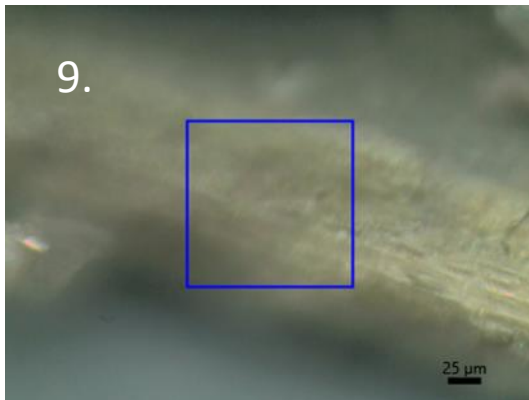
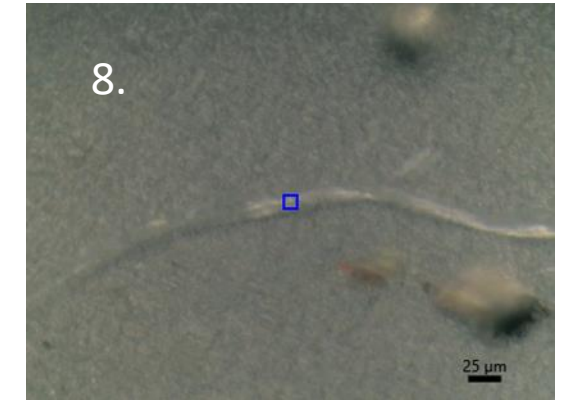
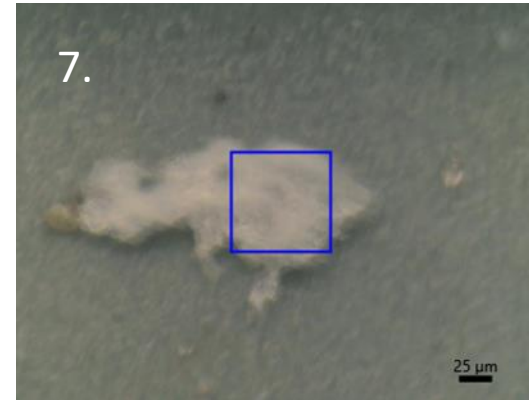
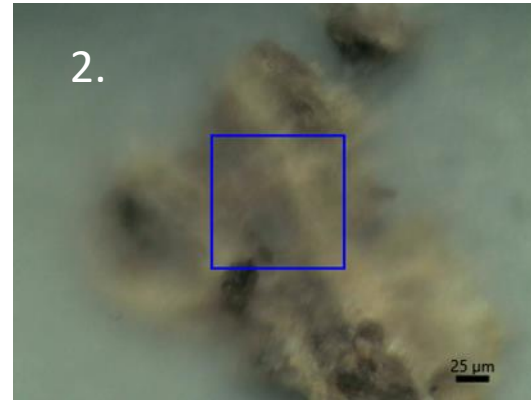
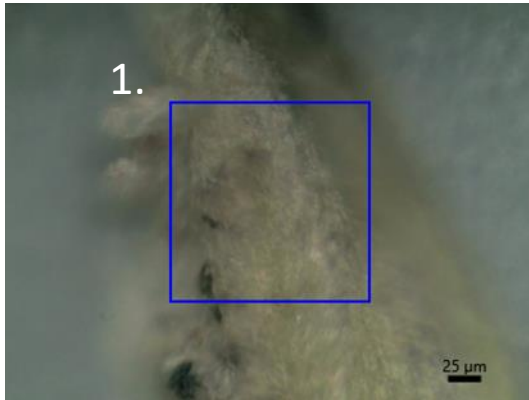
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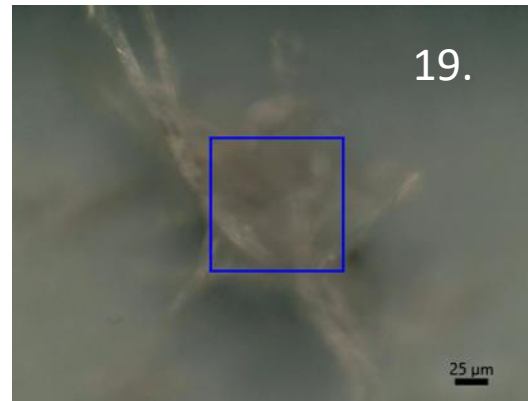
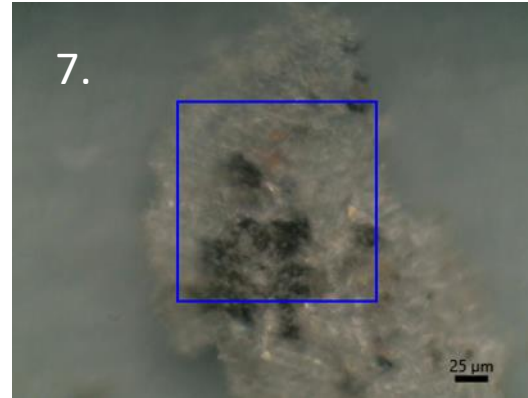
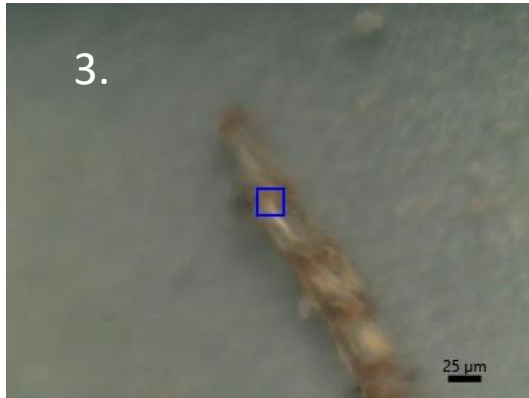
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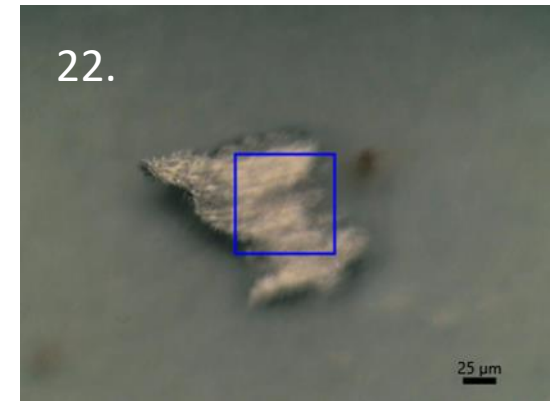
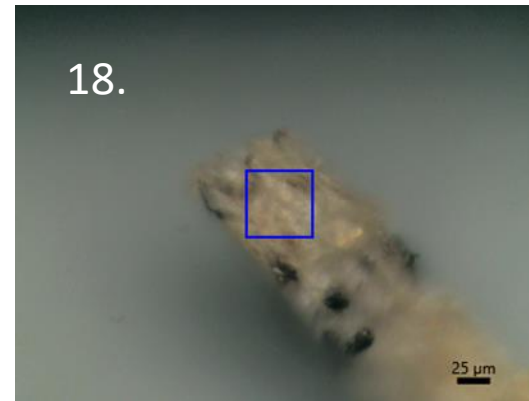
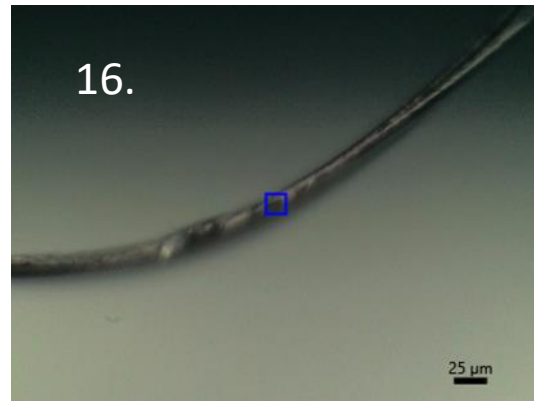
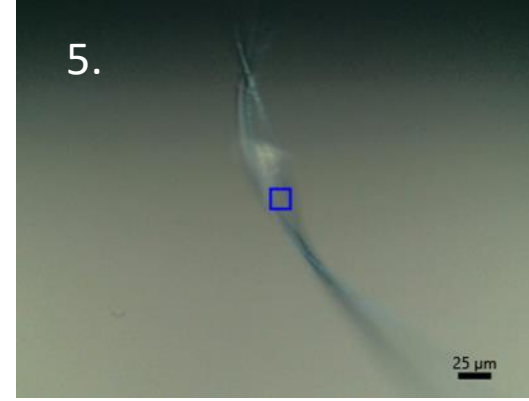
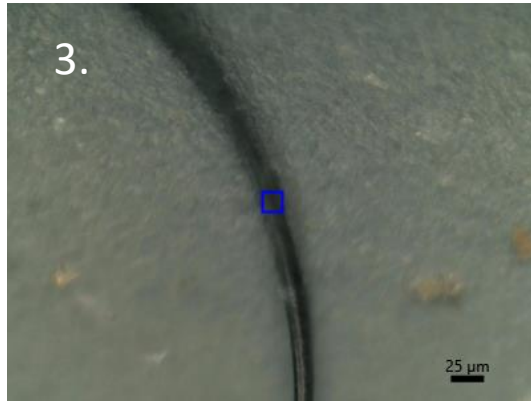
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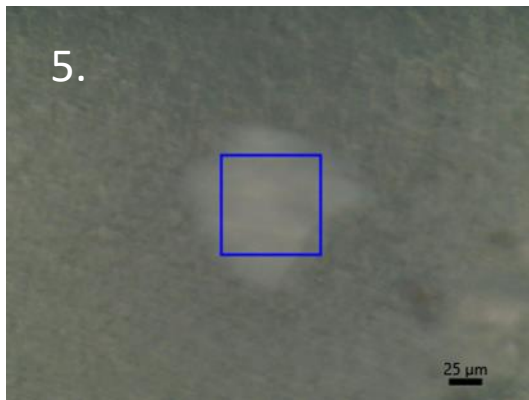
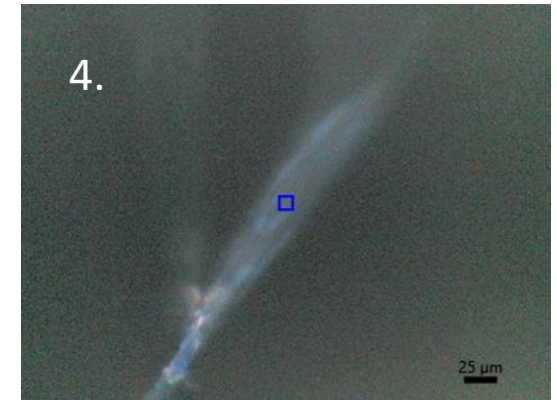
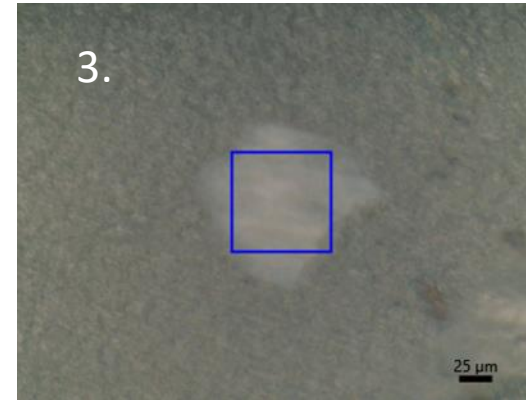
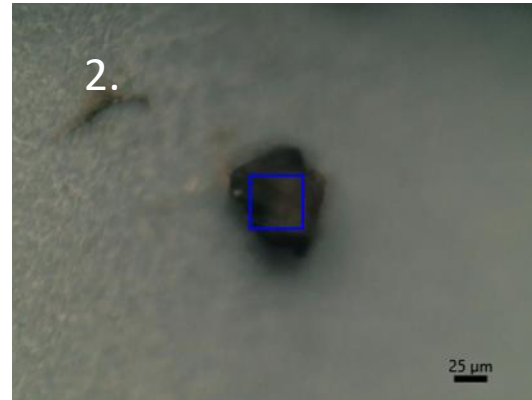
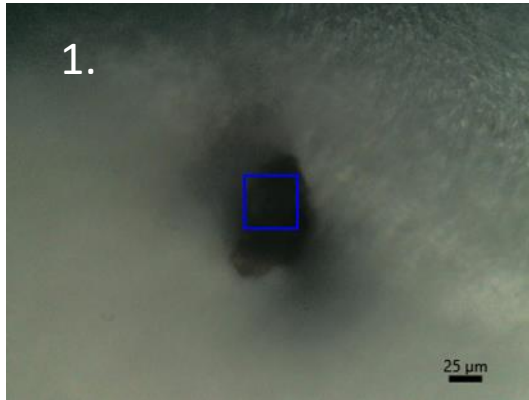
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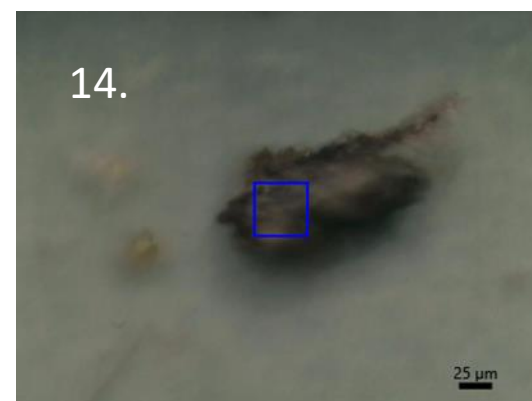
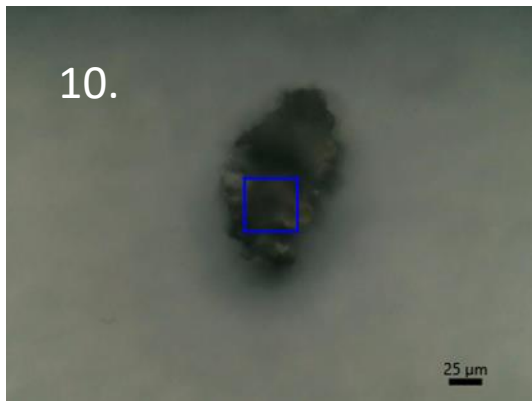
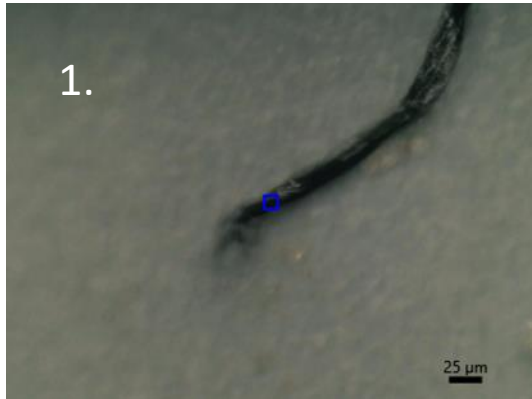
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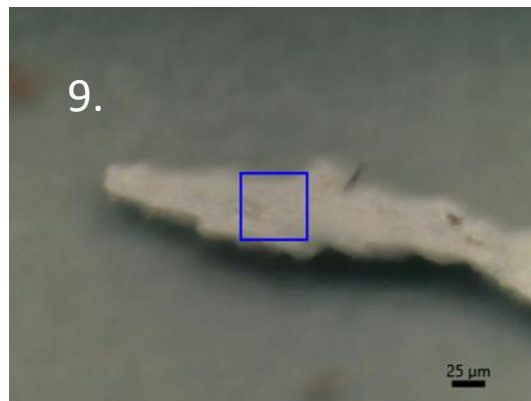
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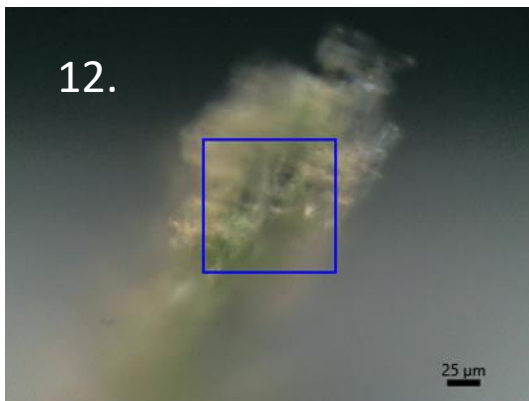
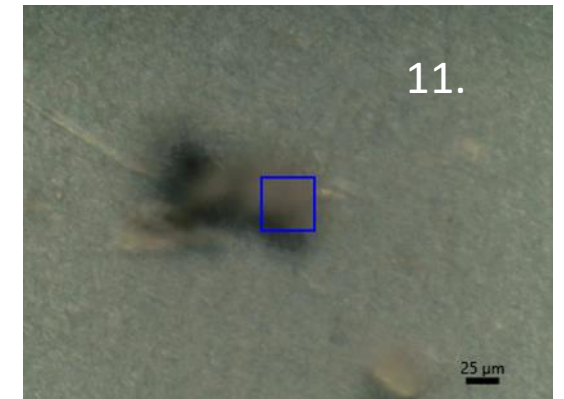
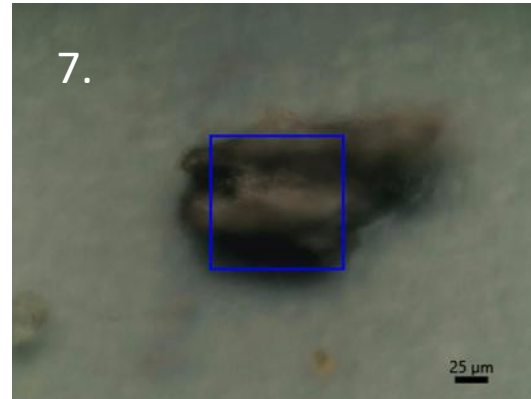
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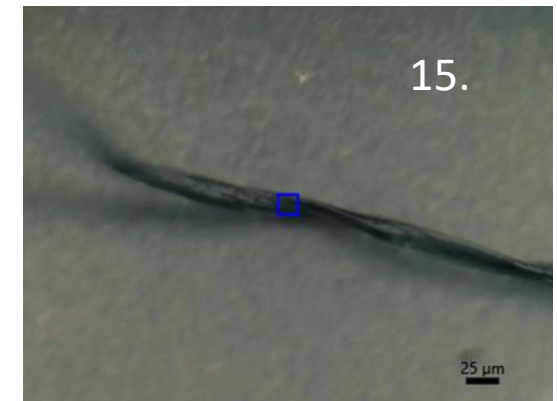
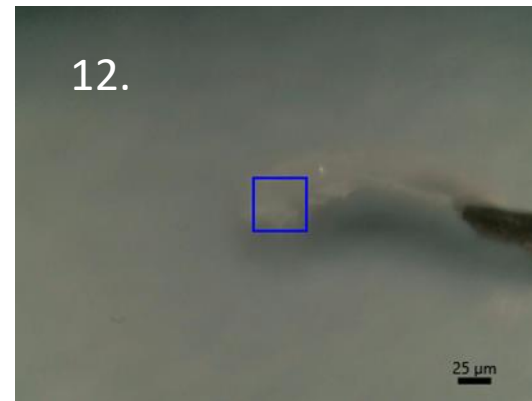
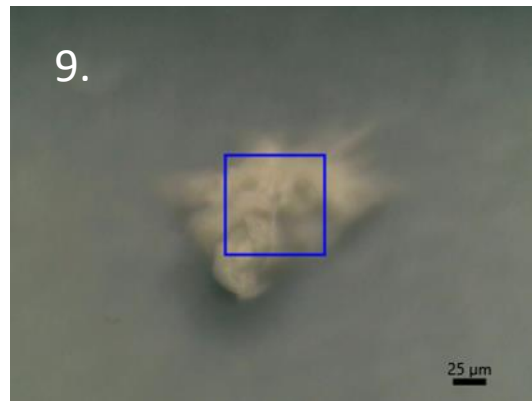
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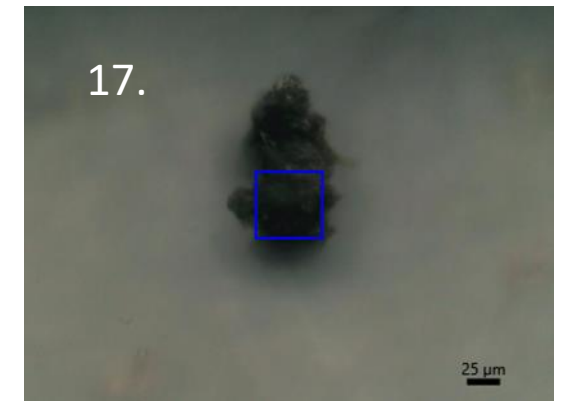
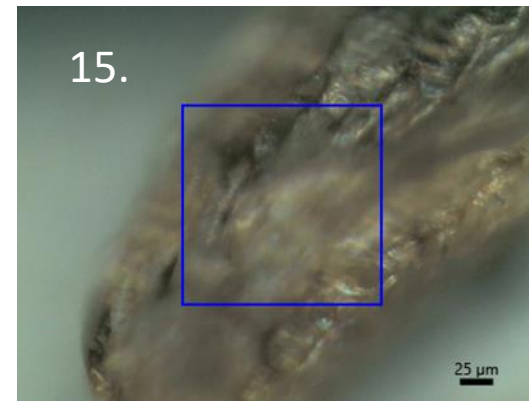
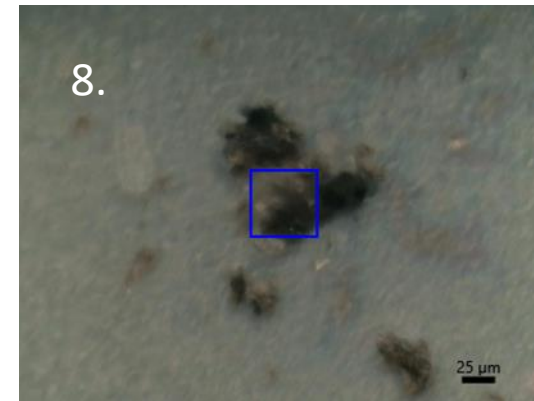
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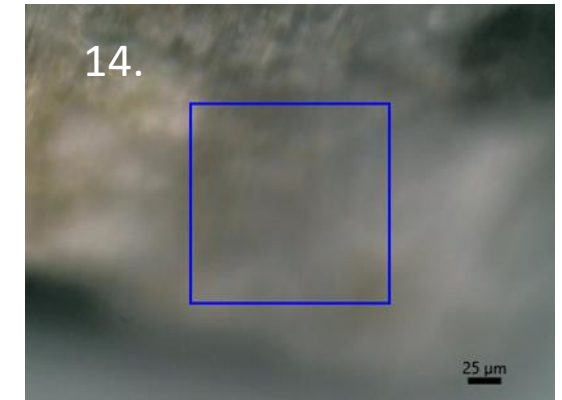
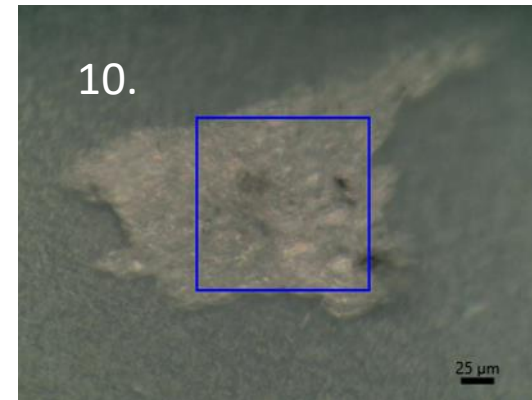
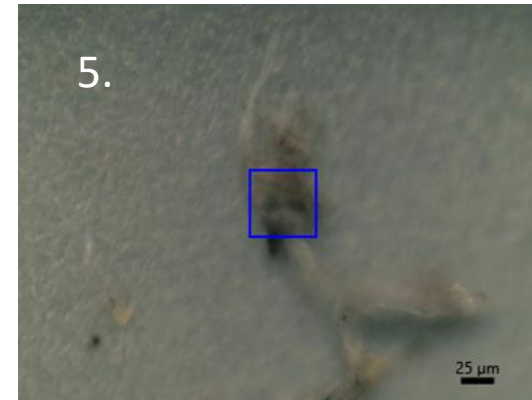
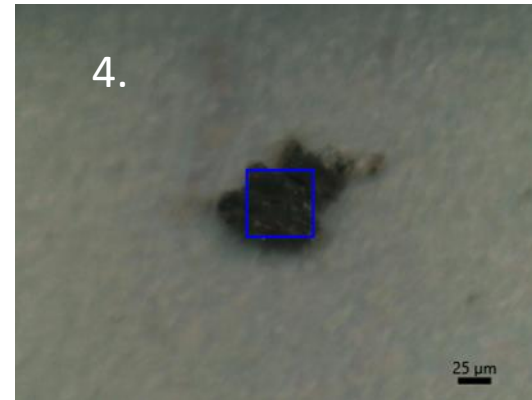
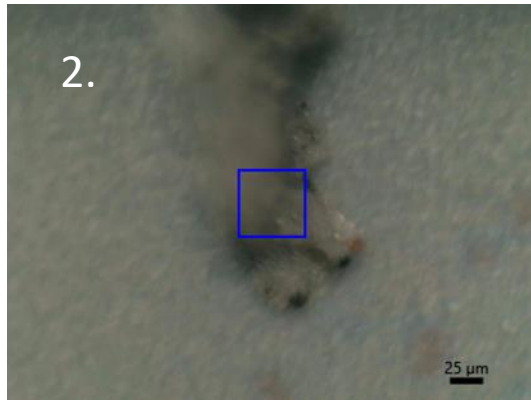
UV042821HA34



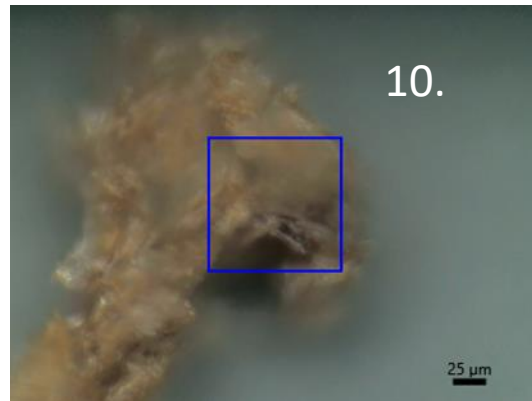
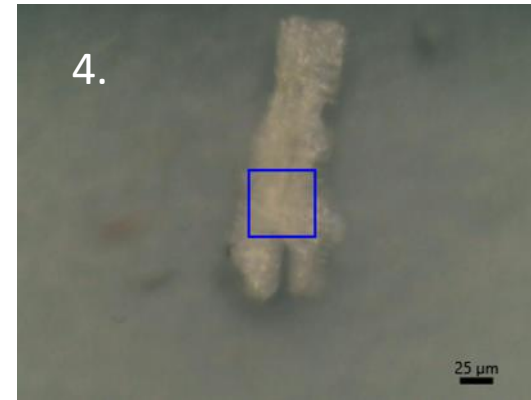
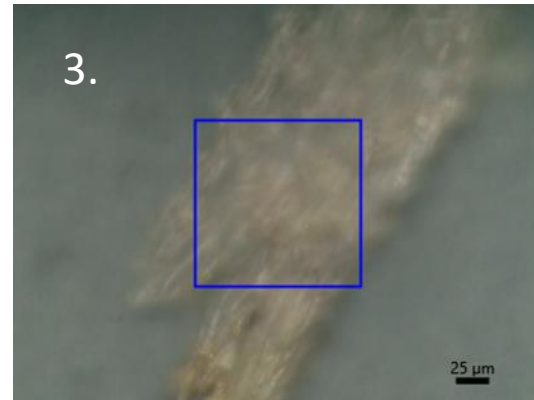
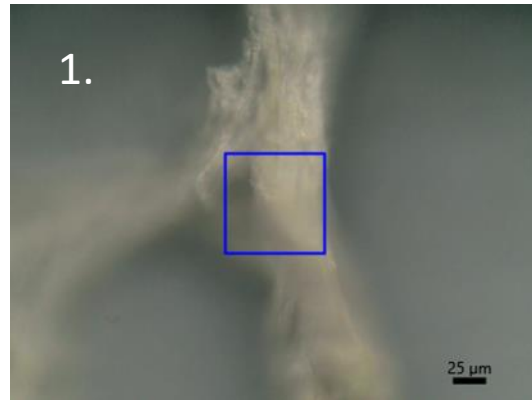
UV042821HA46



UV042821HA48



UV042821HA52



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Sample	number	Type	Score	Maximum Hits	Library	Comment
UV042821HA48	10	Fragment	787	IRs Polymer2	LDPE	Low Density PolyethyleneFilm
DR041120HT03	1	Fragment	768	T-Polymer2	Soy Bean Powder	Protein(Soy Bean Powder) Transmission(Microscope)
DR041120HR01	5	Fragment	729	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA52	17	Fragment	720	T-Polymer2	T_PC2	Polycarbonate(PC) Transmission(Microscope)
UV042821HA05	22	Fragment	718	ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
UV042821HA52	3	Fragment	710	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HE02	8	Fragment	708	ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR041120HR01	7	Fragment	703	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA04	7	Fragment	702	ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR042821HA32	10	fragment	698	ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR041120HG06	5	Fragment	696	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HE02	7	Fragment	695	ATR-Polymer2	D_PC2	Polycarbonate(PC) DuraSamplIR-II
UV042821HA34	5	Fragment	694	ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
UV042821HA22	7	Fragment	692	IRs Polymer2	LANOLINE	LanolineFilm
UV042821HA22	3	Fragment	690	ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
UV042821HA48	6	Fragment	687	IRs Polymer2	NYLON11	Nylon 11 [-NH(CH2)10CO-]nFilm
UV042821HA12	9	Fragment	682	ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
UV042821HA48	14	Fragment	681	T-Polymer2	Polyacetylene	Polyacetylene Transmission(Microscope)
UV042821HA04	17	Fragment	677	ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
UV042821HA12	16	Fragment	669	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA46	15	Fragment	669	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA05	19	Fragment	667	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HR01	9	Fragment	666	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA04	6	Fragment	664	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA04	8	Fragment	664	IRs Polymer2	PC	Polycarbonate/CD-ROMATR/diamond ATRcorrected
DR041120HG06	20	Fragment	663	IRs Polymer2	VLDPE	Low Density PolyethyleneFilm
UV042821HA04	9	Fragment	660	T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HE02	1	Fragment	659	T-Polymer2	T_PC2	Polycarbonate(PC) Transmission(Microscope)
DR041120HR01	13	Fragment	658	T-Polymer2	Paper	Paper Transmission(Microscope)

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DR041120HR01	8 Fiber	656 T-Polymer2	T_PC2	Polycarbonate(PC) Transmission(Microscope)
DR041120HT03	7 Fragment	656 IRs Polymer2	NY-MXD6	Nylon MXD6Film
UV042821HA04	18 Fragment	654 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA04	15 Fragment	652 T-Polymer2	Ramie	Ramie Transmission(Microscope)
DR041120HM01	11 Fragment	651 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HG02	9 Fragment	649 T-Polymer2	T_PC2	Polycarbonate(PC) Transmission(Microscope)
DR041120HG06	18 Fragment	647 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HR01	12 Fragment	647 ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR041120HJ03	6 Fragment	645 ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR041120HT03	10 Fragment	645 ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR041120HE02	9 Fragment	644 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HG06	7 Fragment	644 ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR041120HG06	13 Fragment	644 ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
UV042821HA04	11 Fragment	642 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HT03	4 Fragment	641 T-Polymer2	Polyacetylene	Polyacetylene Transmission(Microscope)
UV042821HA04	14 Fragment	641 ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
UV042821HA31	2 Fragment	640 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA52	1 Fragment	640 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
DR041120HT03	9 Fragment	638 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA04	12 Fragment	637 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA04	19 Fragment	637 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA52	4 Fragment	637 ATR-Polymer2	D_Epoxy5	Epoxy Resin DuraSamplIR-II
UV042821HA12	15 Fragment	636 ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR042821HA32	5 fragment	635 T-Polymer2	T_PhenoxyResin	Phenox Resin Transmission(Microscope)
DR041120HE02	5 Fragment	635 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)
UV042821HA04	20 Fragment	634 T-Polymer2	FEP	Tetrafluoroethylene-Hexafluoropropylene(FEP) Transmission(Microscope)
DR042821HA32	6 fragment	632 ATR-Polymer2	D_PC	Polycarbonate(PC) DuraSamplIR-II
DR041120HR01	4 Fragment	632 T-Polymer2	PC	Polycarbonate(PC) Transmission(Microscope)

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UV042821HA12	14 Fragment	583 T-Polymer2	PVDF	Polyvinylidene Fluoride(PVDF) Transmission(Microscope)
UV042821HA31	6 Fiber	583 ATR-Polymer2	D_Additive1	Polymer Additive(Irganox 1010) DuraSamplIR-II
DR041120HG06	4 Fiber	584 ATR-Polymer2	D_PI3	Polyimide(Electronic Parts) DuraSamplIR-II
UV042821HA04	16 Fiber	584 ATR-Polymer2	D_Polyethyleneglycol	Polyethylene Glycol 20000 DuraSamplIR-II
UV042821HA46	1 Fiber	584 IRs Polymer2	PVDC	PVDC,Poly (vinylidene chloride) /wlap filmATR/diamond ATRcorrected
DR042821HA32	4 fiber	585 T-Polymer2	Epoxy	Epoxy Adhesives Transmission(Microscope)
DR041120HG06	11 Fiber	585 ATR-Polymer2	D_PVDF	Polyvinylidene Fluoride(PVDF) DuraSamplIR-II
UV042821HA46	3 Fragment	585 ATR-Polymer2	D_PP_Chlorinated	Polypropylene, Chlorinated(Chlorine content 65%) DuraSamplIR-II
				Irganox MD1024 HINDERED PHENOLIC ANTIOXIDANT-METAL DEACTIVATOR1,2-BIS(3,5-DI-tert-BUTYL-4-HYDROXYHYDROCINNA MOYL)HYDRAZINE; HINDERED PHENOLC34H52O4N2CAS NO. 32687-78-8ATR/diamond ATRcorrected
UV042821HA48	3 Fragment	585 IRs Polymer2	IrganoxMD1024	
DR041120HG02	4 Fiber	586 ATR-Polymer2	D_Poly_1_Butene	Poly(1-Butene), Isotactic DuraSamplIR-II
DR041120HG06	3 Fiber	586 IRs Polymer2	BUTYL_RB	Butyl rubber with salt(salt:1540,1016,876cm-1)ATR/diamond ATRcorrected
UV042821HA05	8 Fiber	586 IRs Polymer2	LLDPE1	Low Density PolyethyleneFilm
UV042821HA11	2 Fragment	586 ATR-Polymer2	D_Additive2	Polymer Additive(Irganox 1076) DuraSamplIR-II
UV042821HA34	11 Fragment	586 ATR-Polymer2	D_Polysulfone	Polysulfone DuraSamplIR-II
DR041120HJ03	7 Fragment	587 T-Polymer2	PEG	Polyethylene Glycol 20000 Transmission(Microscope)
DR041120HM01	9 Fragment	587 T-Polymer2	Epoxy7	Epoxy Resin Transmission(Microscope)
DR041120HR01	1 Fiber	587 T-Polymer2	T_1_2_Polybutadiene	1,2-Polybutadiene Transmission(Microscope)
UV042821HA05	18 Fragment	587 ATR-Polymer2	D_Additive4	Polymer Additive(Irganox MD1024) DuraSamplIR-II
UV042821HA31	3 Fragment	587 ATR-Polymer2	D_Poly_4_Methyl_1_Pentene	Poly(4-Methyl-1 Pentene) DuraSamplIR-II
UV042821HA34	10 Fragment	587 ATR-Polymer2	D_IIR	IIR(Isobutylene-Isoprene Rubber) DuraSamplIR-II
DR041120HG06	16 Fragment	588 ATR-Polymer2	D_PC2	Polycarbonate(PC) DuraSamplIR-II
DR041120HM01	10 Fiber	588 ATR-Polymer2	D_Polyester4	Polyester Film(TOYOB0 ESTER FILM & ESPET FILM) DuraSamplIR-II
DR041120HT03	3 Fragment	588 T-Polymer2	Irganox 1330	Polymer Additive(Irganox 1330) Transmission(Microscope)
UV042821HA05	11 Fiber	588 ATR-Polymer2	D_PC-PBT	Polycarbonate/Polybutylene Terephthalate(PC/PBT) DuraSamplIR-II
UV042821HA05	24 Fragment	588 ATR-Polymer2	D_Epoxy6	Epoxy Adhesives DuraSamplIR-II
UV042821HA31	14 Fragment	588 ATR-Polymer2	D_Additive3	Polymer Additive(Irganox 1330) DuraSamplIR-II