

INLINE PLASTICS ANALYSIS USING A HYPERSPECTRAL CAMERA ♡ ♡' ♡ ♡

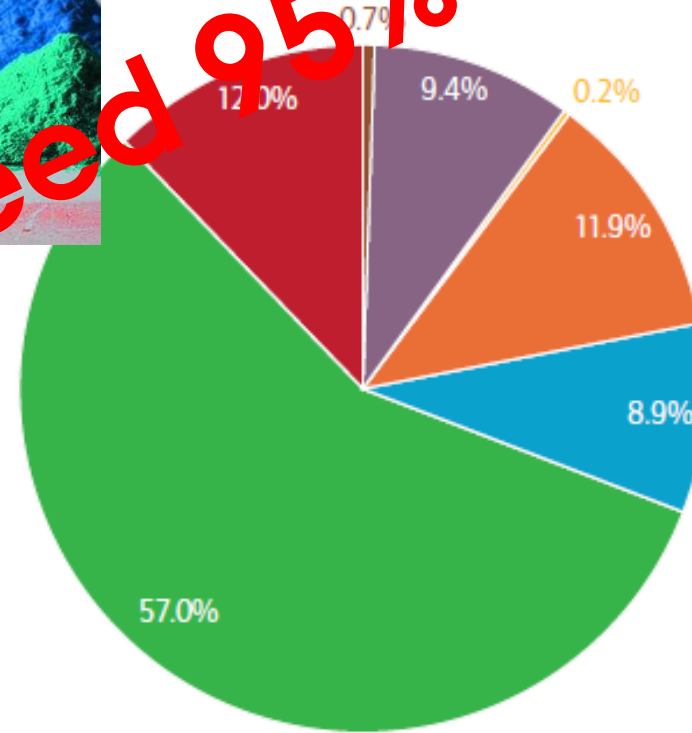
By Mogens Hinge, 8/11-2024

PLASTICS...



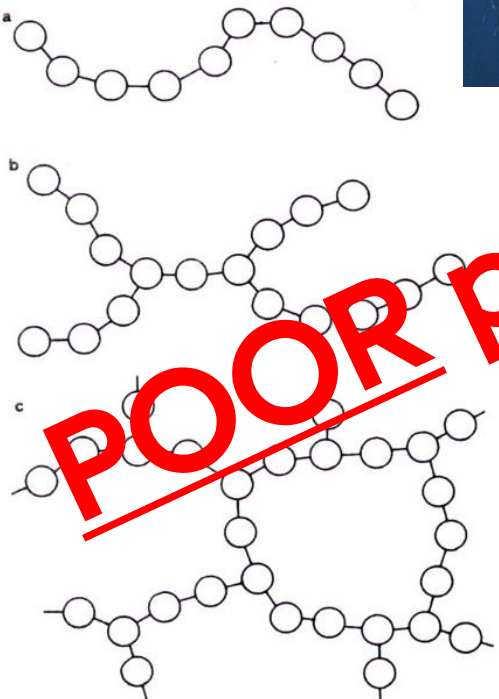
WHAT IS PLASTICS?

- Polymer
- Fillers
- Color
- Additives



- UV stabilisers
- Antioxidants
- Antimicrobials
- Anti-fog
- Antistatic
- Clarifying agents
- Oxygen scavengers

POOR plastic purity (Need 95%+ purity)



CHEMICAL

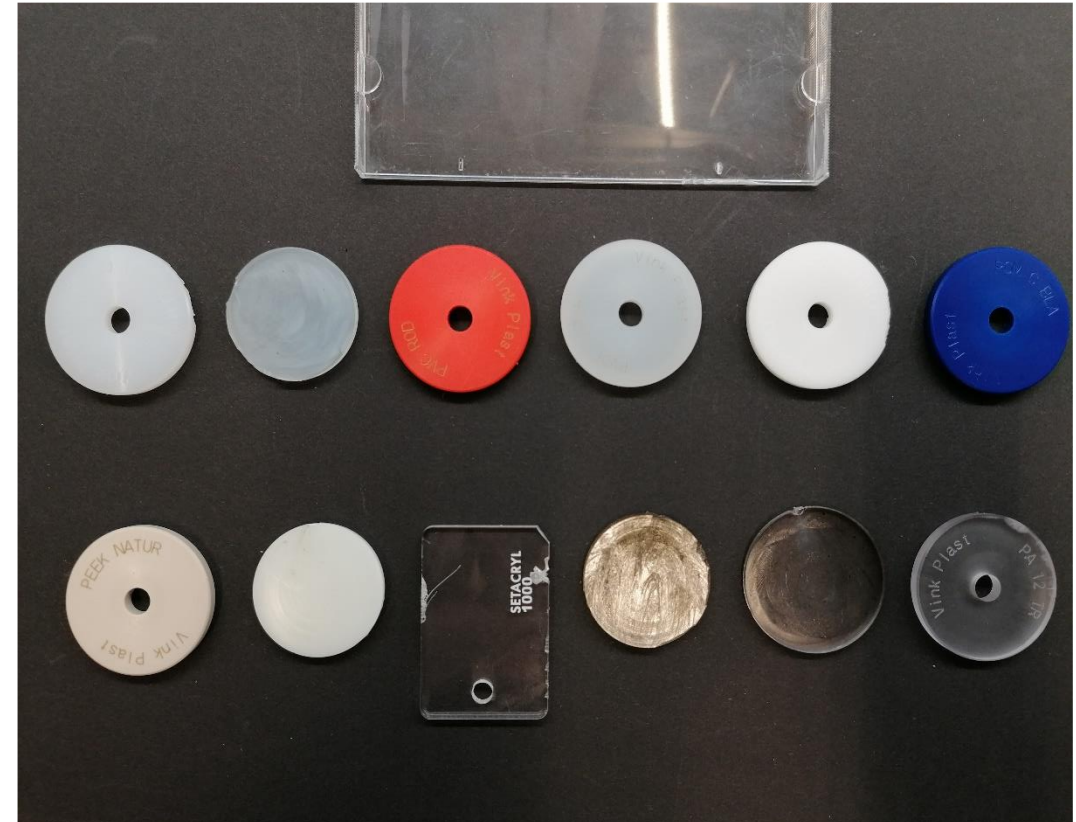


INDUSTRIAL MATERIALS

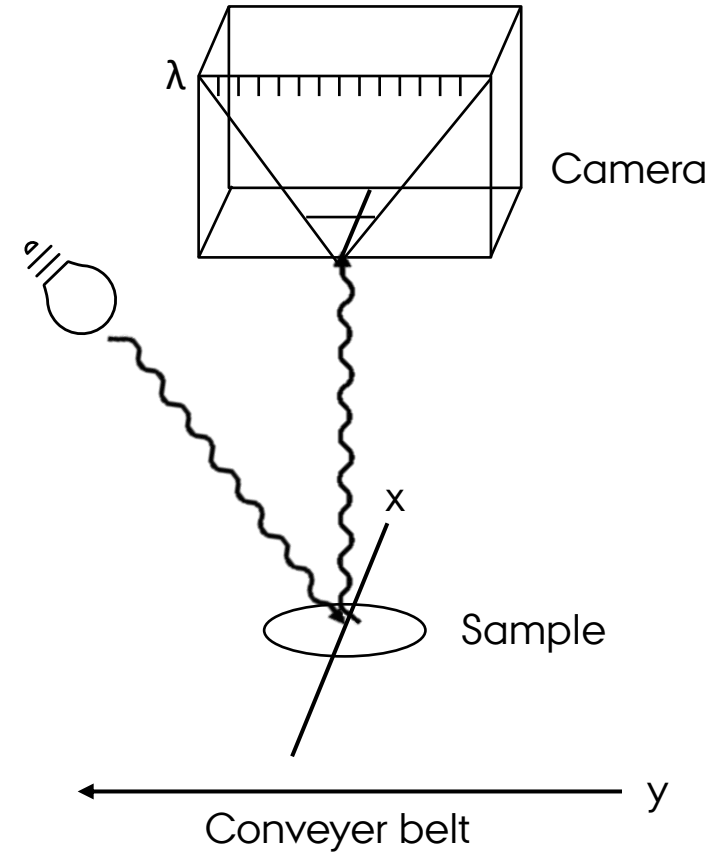
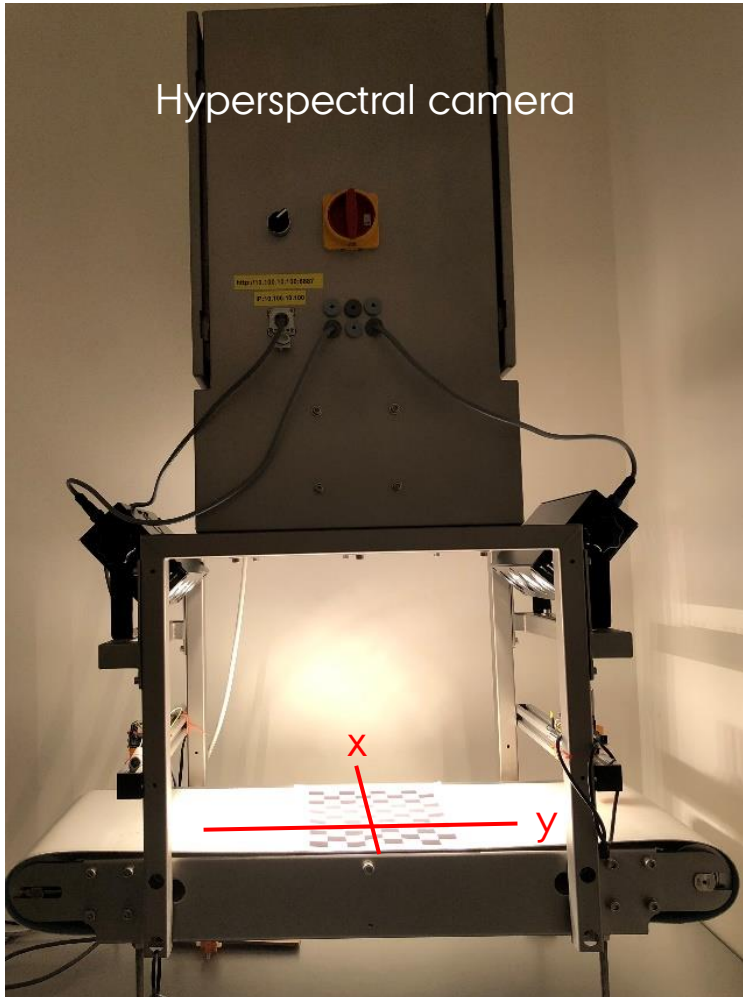
Table 1

Plastic identification, plastic type, trade name, supplier for the materials included in this study.

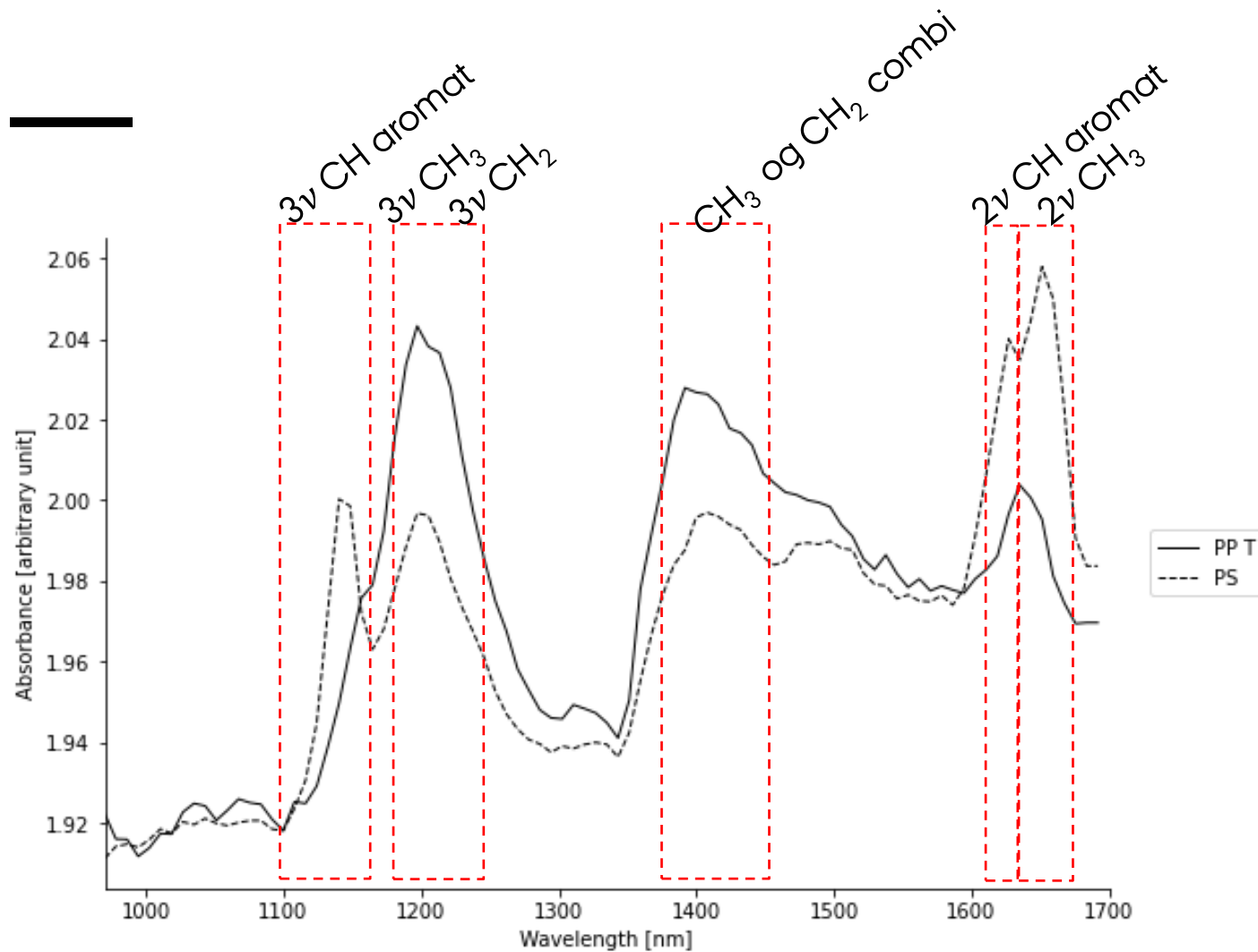
ID	Plastic type	Name	Supplier
HDPE	Polyethylene	PE 100	SIMONA
PP	Polypropylene	240-CA12	INEOS
PS	Polystyrene	CD cover	-
PVC	Poly(vinyl chloride)	PVC-U	GEHR
PVDF	Poly(vinylidene difluoride)	PVDF	GEHR
POM N	Polyoxymethylene	Ertacetal C	Mitsubishi
POM B	Polyoxymethylene	Ertacetal C	Mitsubishi
PEEK	Polyetheretherketone	Ketron PEEK 1000	Mitsubishi
ABS	Poly(acrylonitrile-butadiene-styrene)	Terluran GP35	INEOS
PMMA	Poly(methyl methacrylate)	Setacryl 1000	Madreperla
PC	Polycarbonate	Makrolon 2652	Covestro
PET	Poly(ethylene terephthalate)	CB-602	UltraPurge
PA12	Polyamide 12	PA 12-TR	GEHR
U1	Unknown	Weighing boat (White)	VWR
U2	Unknown	Plexiglas	Rias
U3	Unknown	Safety glasses	VWR



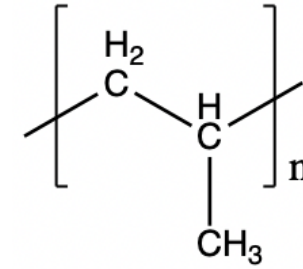
HYPERSENSITIVE CAMERA – PUSH BROOM



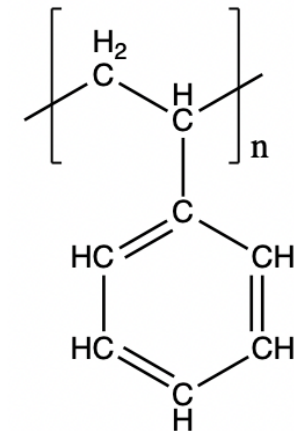
SPECTRAL ASSIGNMENT



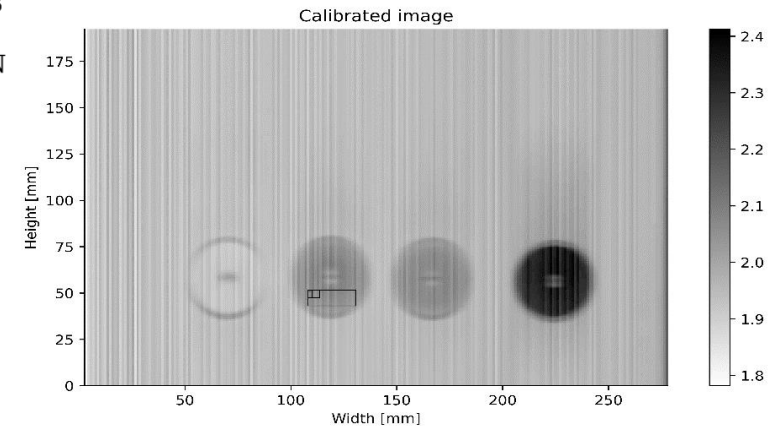
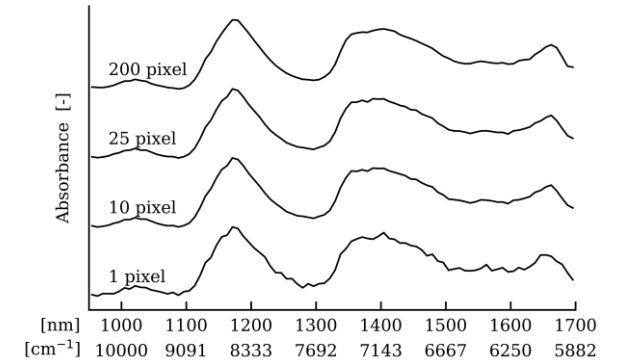
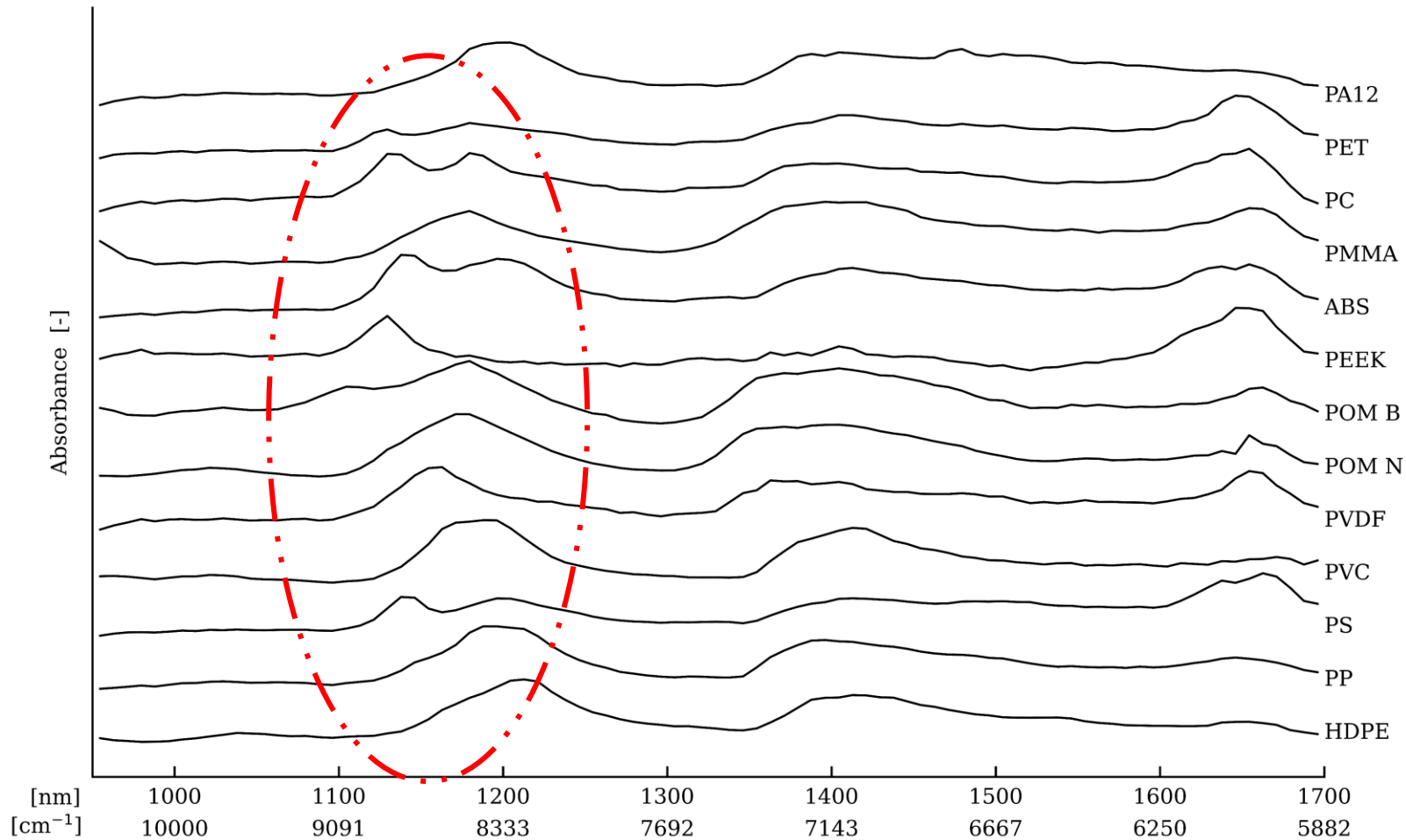
Polypropylene



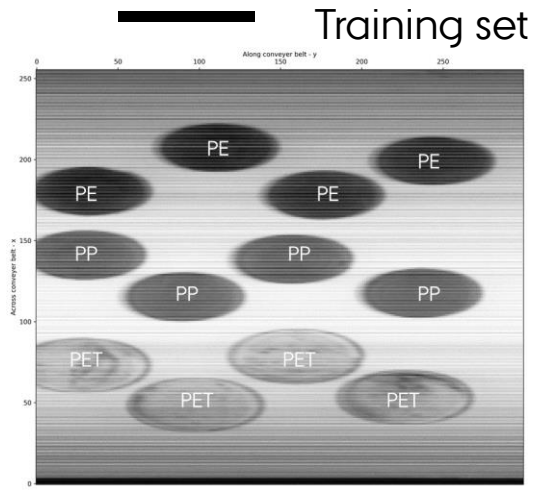
Polystyrene



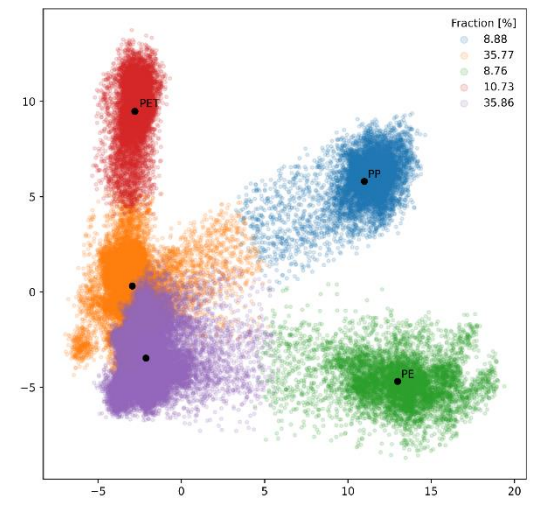
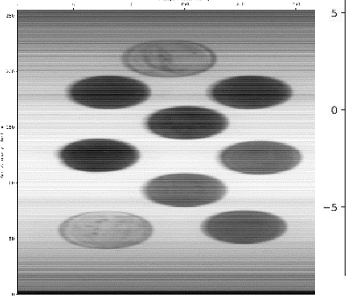
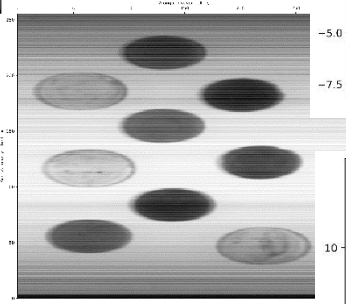
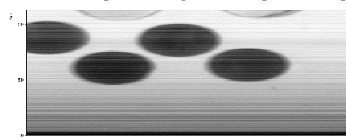
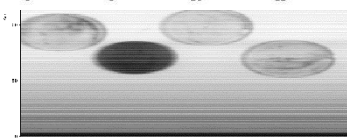
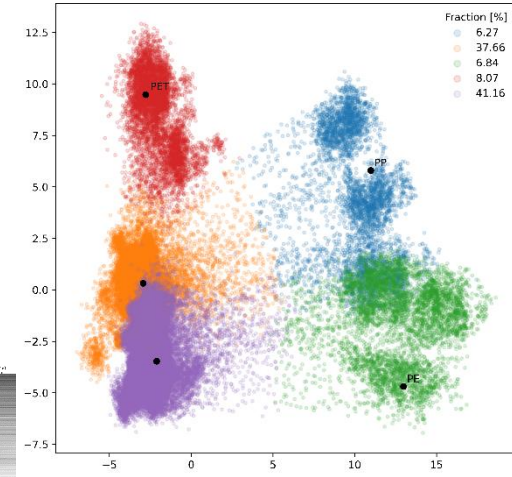
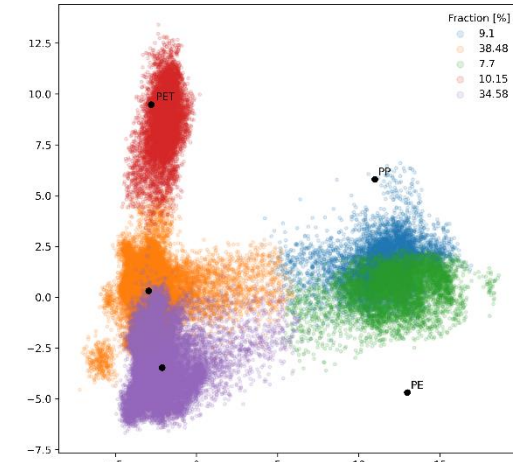
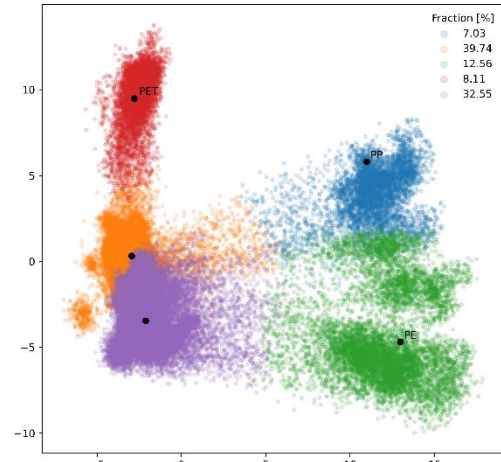
PLASTIC IDENTIFICATION



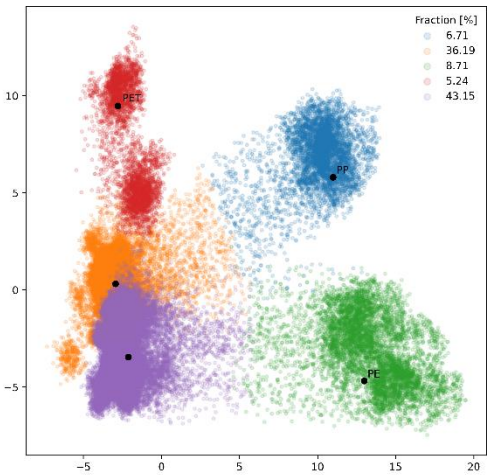
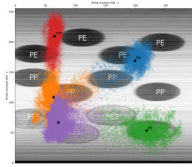
IDENTIFICATION VIA PCA AND K-MEANS



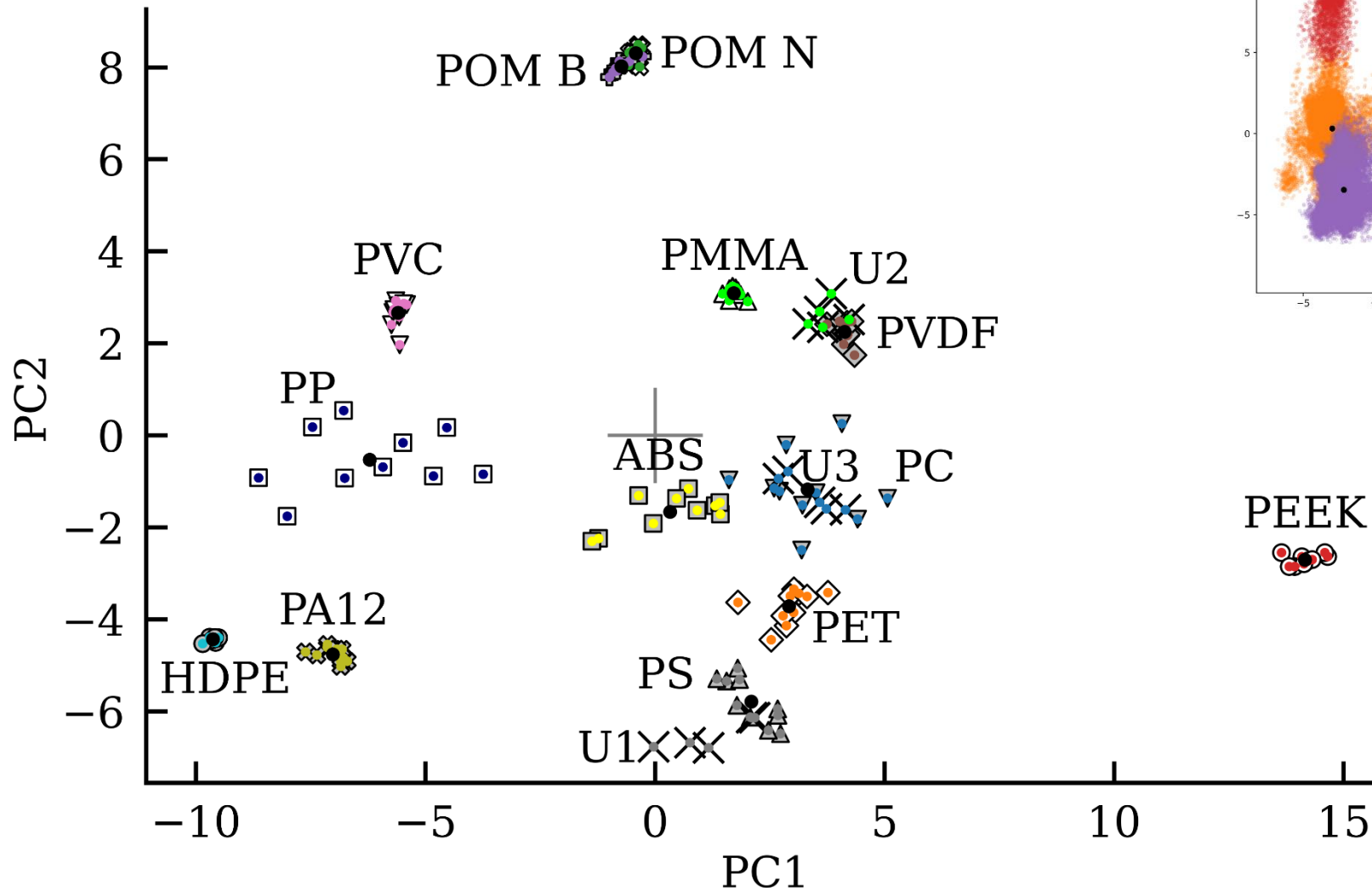
PCA, Cluster



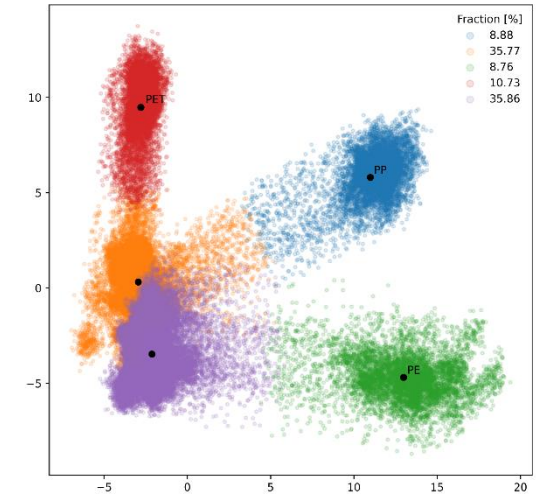
Transfer Model



PLASTIC IDENTIFICATION

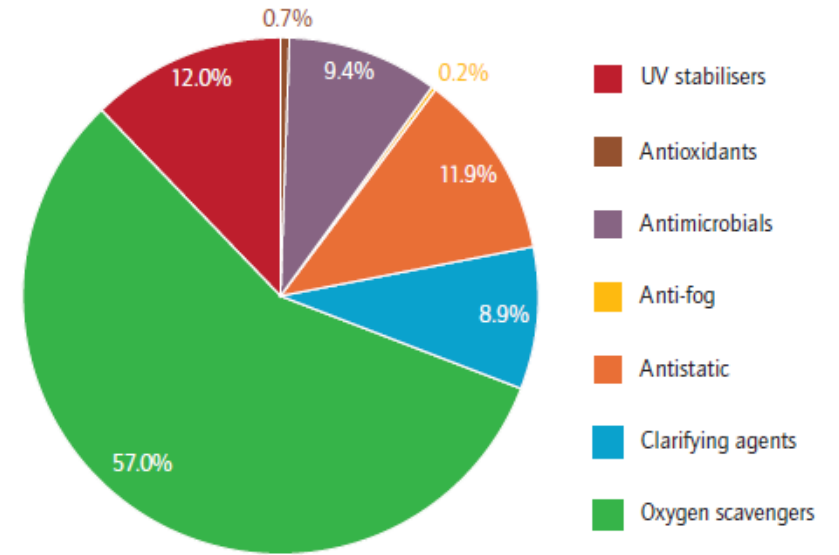


PCA and K-means



BUT HOW MUCH???

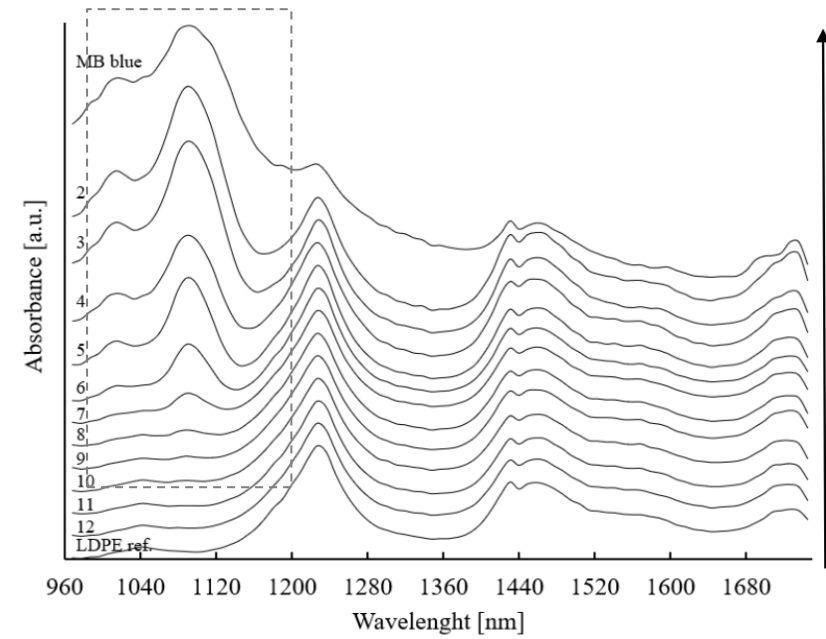
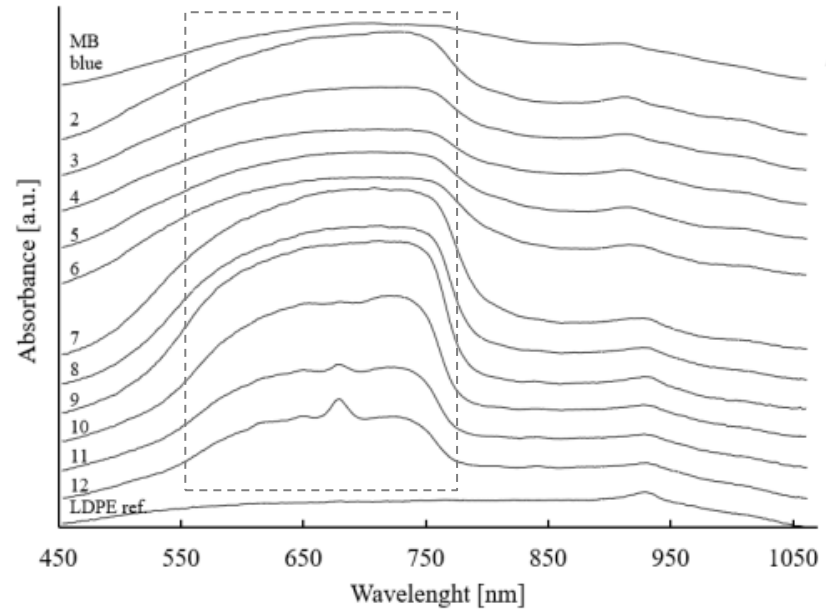
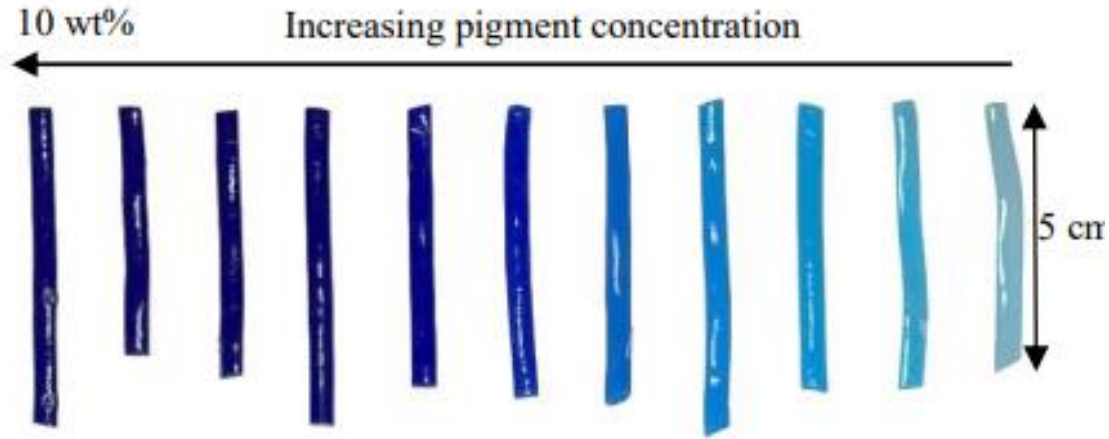
Plastic mixtures
Fillers
Pigments
Flame-retardants



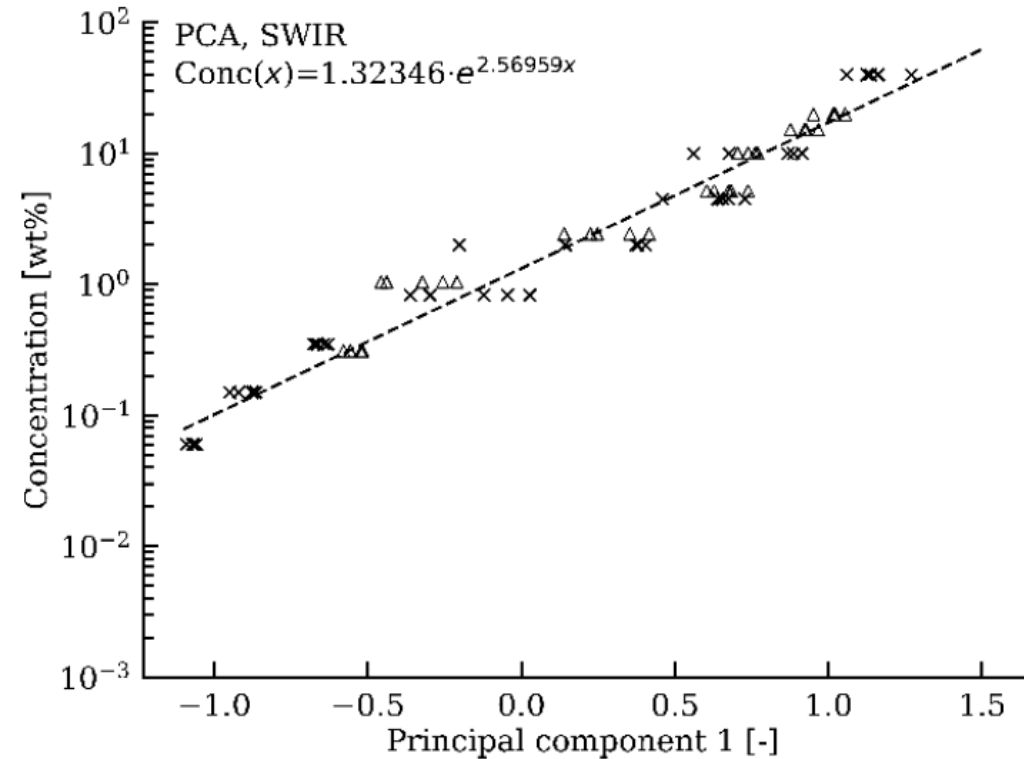
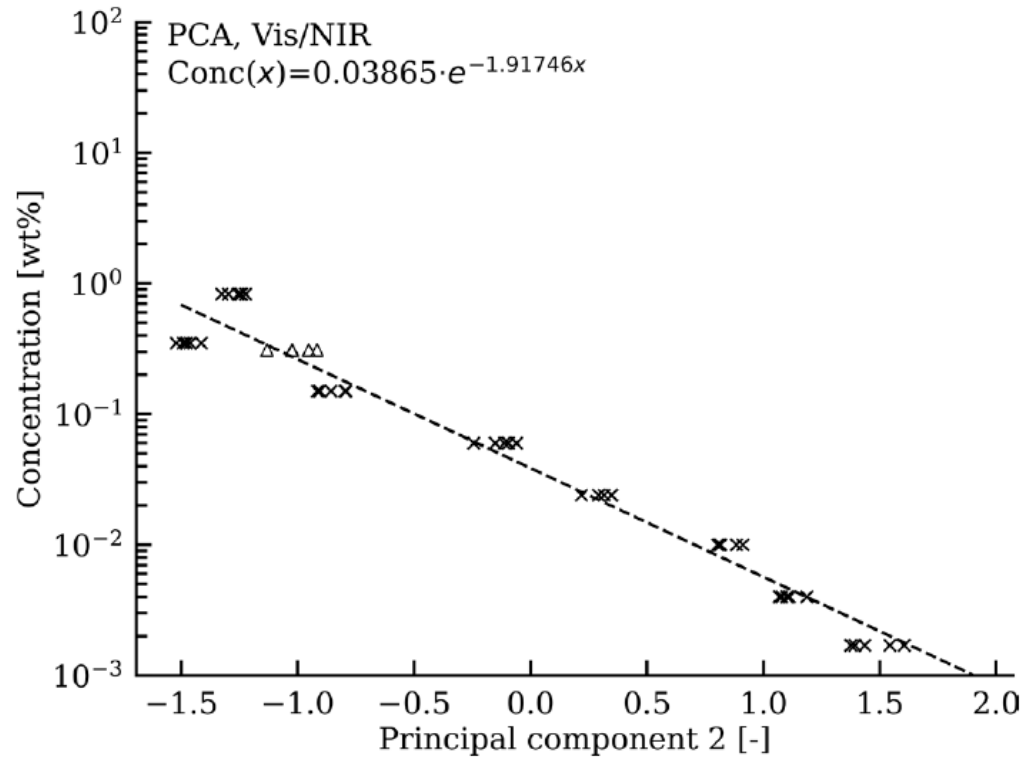
Source: Random images from the internet



BLUE PIGMENTS (VIS AND NIR)



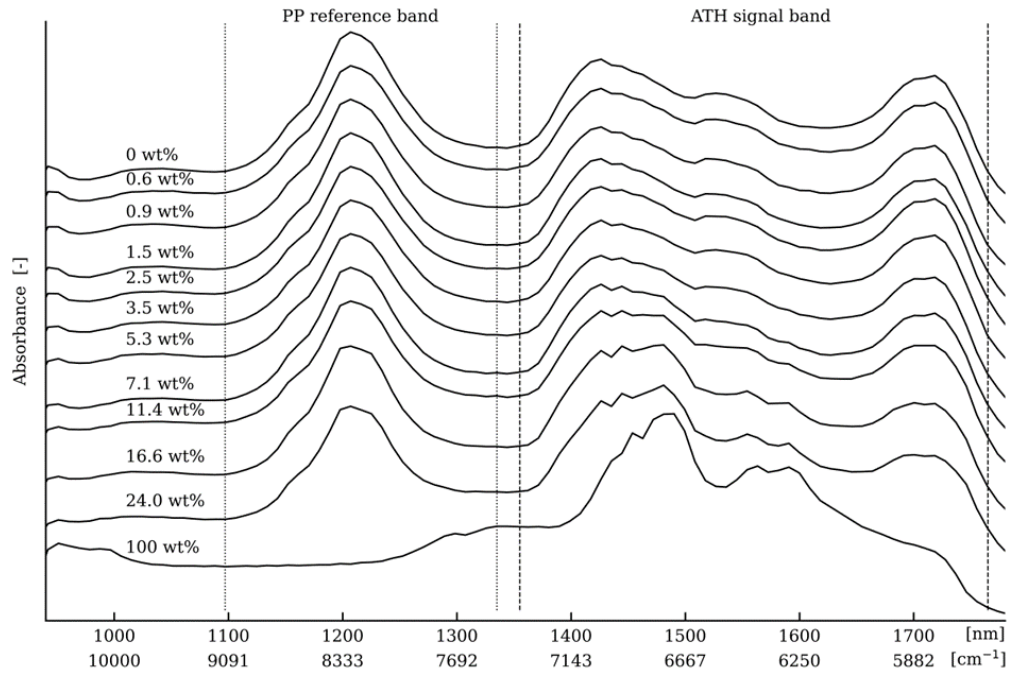
BLUE PIGMENT MODELLING



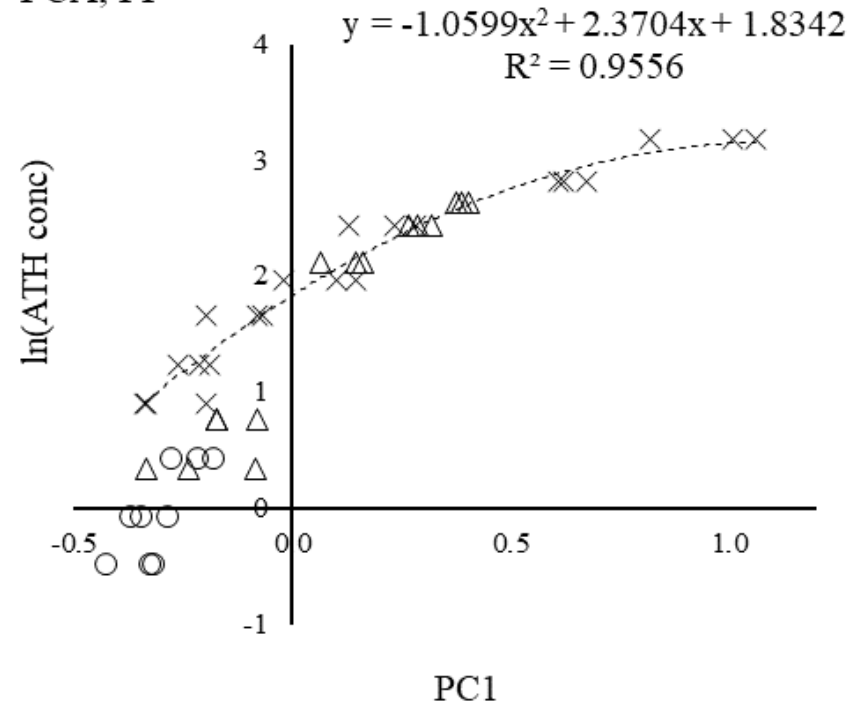
G. Amariei et al., *J. Spectral Imaging* **12**, a2 (2023)



ALUMINIUM TRIHYDRATE FLAME RETARDANT IN PP



PCA, PP



24.0 to 2.5 wt% ATH in PP

Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy 311 (2024) 123984





The Wall

www.re-plast.dk

- Polyamide 6
- Poly(Acrylonitrile-Butadiene-Styrene)
- High-Density Polyethylene
- Polyamide 12
- Polyether ether ketone
- Poly(oxymethylene)
- Poly(oxymethylene)
- Polyvinylidene fluoride
- Polyvinyl chloride
- High-Density Polyethylene
- High-Density Polyethylene
- Poly(methyl methacrylate)
- Poly(methyl methacrylate)
- Poly(methyl methacrylate)
- Floating Fraction Mix
- Polypropylene Flakes
- Polyethylene Flakes
- Poly(ethylene)-poly(propylene)
- rHDPE
- Pure Pigment
- Polypropylene
- Poly(ethylene terephthalate)
- Polyethylene
- Poly(Acrylonitrile-Butadiene-Styrene)

Poly(Acrylonitrile-Butadiene-Styrene)

Searchable under these terms: Acrylonitrile butadiene styrene, ABS, Poly(acrylonitrilo/butadiene/styrene), 4

Description:
Acrylonitrile butadiene styrene



Master Data

Elements placement	1,4
Pellets placement	4
Storage placement	
Company	INCOES
Trade Name	
Formula (SMILES)	<chem>(\$CC(C)*N)\$, \$CC=C(C)\$, \$CC(c1ccccc1)\$</chem>
Glass transition temperature (Tg) [°C]	
Melting temperature (Tm) [°C]	250
Expansion [µm/m]	
Density [g/mL]	1.040

Thermal Analysis

DSC
[Download Image](#)

TGA AIR
[Download Image](#)
[Data Text File \(427.77 KB\)](#)

TGA N2
[Download Image](#)
[Data Text File \(430.00 KB\)](#)

Chemical Analysis

IR
[Download Image](#)
[Data Text File \(296.51 KB\)](#)



I AM NOT ALONE IN PPE



THANK YOU FOR YOUR ATTENTION

Plastic and Polymer Engineering
Assoc. Prof. Mogens Hinge
hinge@eng.au.dk



Psssst... we are hiring.



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