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Microplastics released from antifouling coatings

Microplastics

Definition:

1. (Semi-)synthetic polymer
2. Solid particle
3. 1-1000 μm
4. Non-soluble

Risks:

- Toxic (at high concentrations)
- (Nearly) irreversible accumulation



Photo credit: Chesapeake Bay program, Will Parson

(Fouling control) coating particles

Table 1
Morphological types of MPs in found across studies including paint particles as an independent category.

Location	Paints (%)	Fibers (%)	Fragments (%)	Other (%)	Reference
Baltic Sea	19	77	4	0	(Bagaev et al., 2018, 2017)
Mediterranean Sea (Cartagena)	8	–	–	92	(de Haan et al., 2019)
Spain (Ría de Vigo)	15	56	6	23	(Díez-Minguito et al., 2020)
Mediterranean Sea (Campo de Dalias)	4	–	–	96	(de Haan et al., 2019)
Korea (Urban bays)	22.8	35.8	24.2	17.2	(Kwon et al., 2020)
Korea (Rural bays)	13.5	31.9	15.7	38.9	(Kwon et al., 2020)
Korea (Jinhae Bay)	52	5.8	23	19.2	(Song et al., 2015)
Korea (Southern Coast)	92.4	0.2	7.2	0.2	(Song et al., 2014)
Western Tropical Atlantic Ocean (Noronha Archipelago)	11.5	–	76.9	11.5	(Ivar Do Sul et al., 2014)
Western Tropical Atlantic Ocean (Trindade Island)	17.6	–	71.2	11.2	(Ivar Do Sul et al., 2014)
Brazil (Goiana Estuary)	29.1	1.4	28.4	41.1	(Lima et al., 2014)

(Fouling control) coating particles

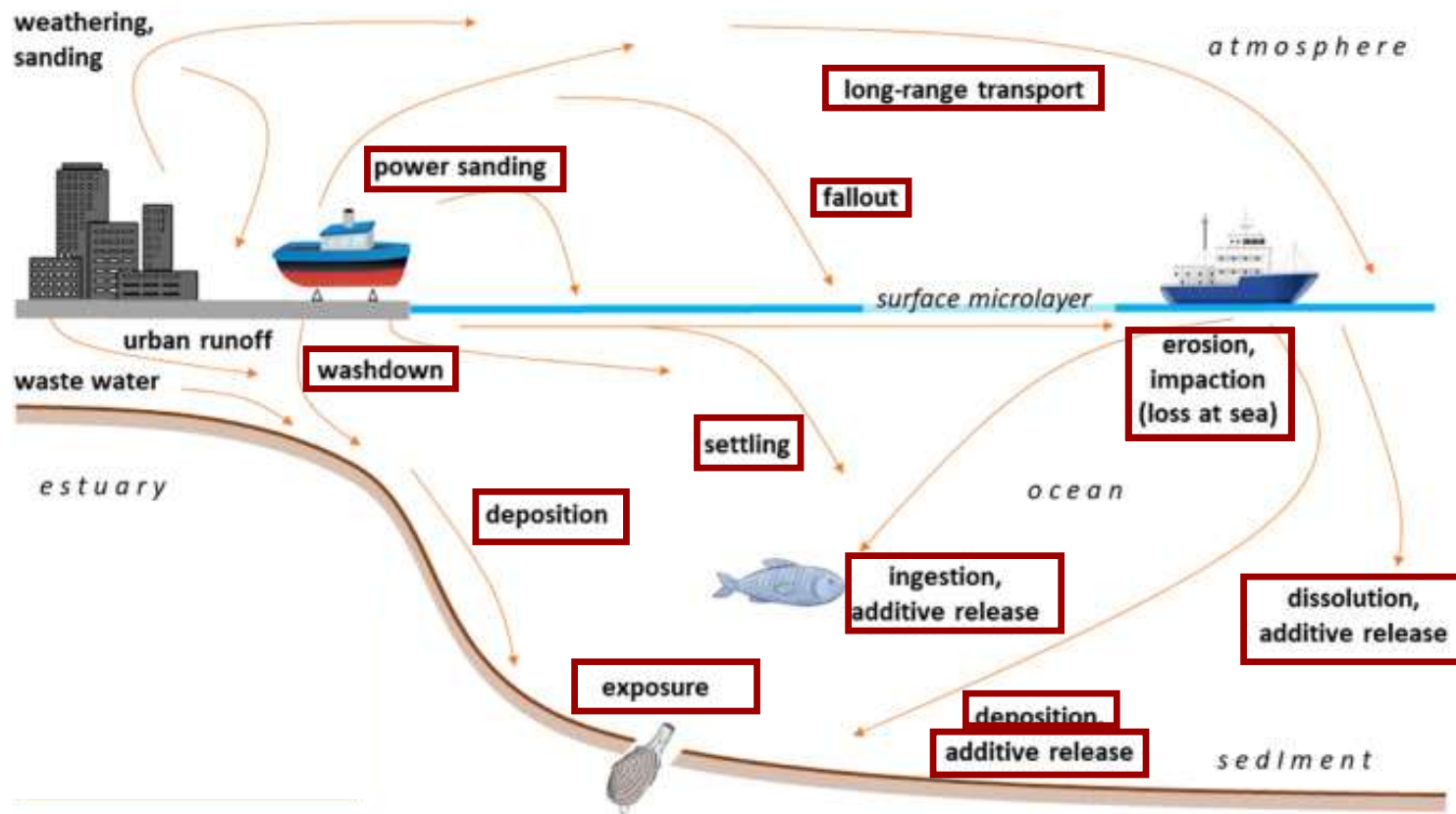
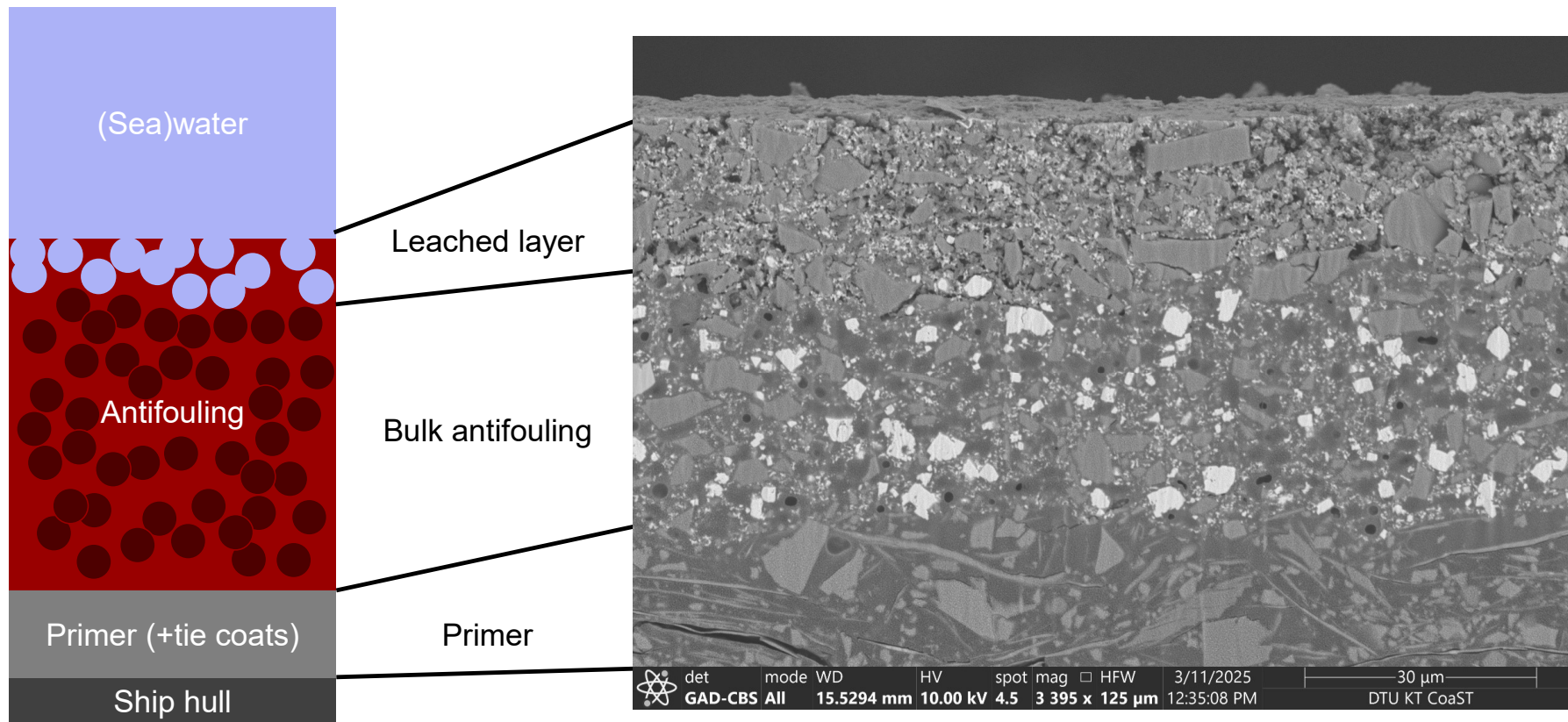


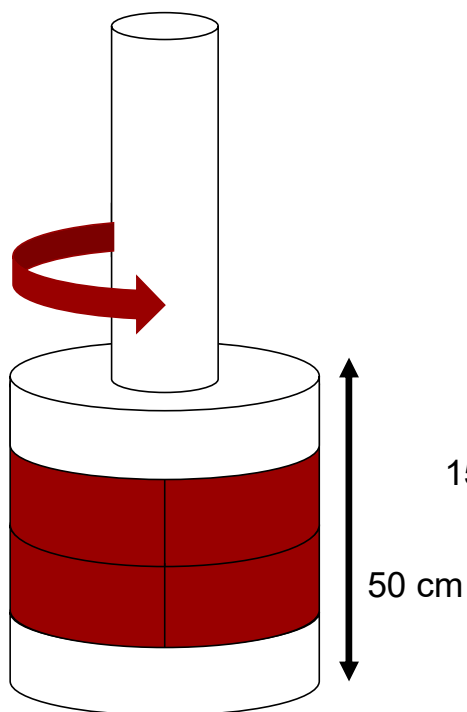
Image credit: Turner et al. Water Research X 12 (2021)

Self-polishing coatings

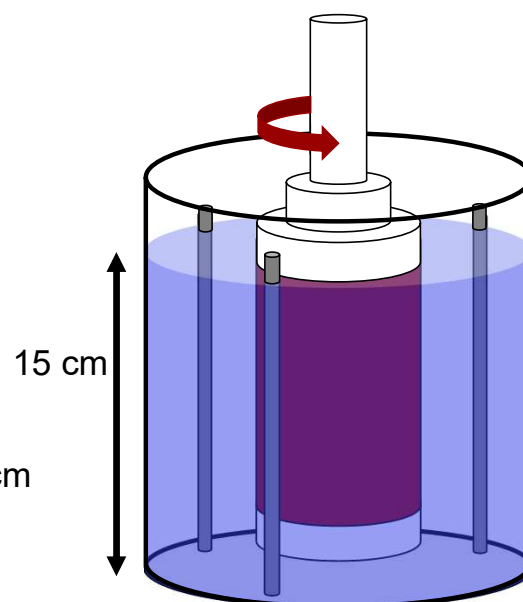


Measuring microplastic release

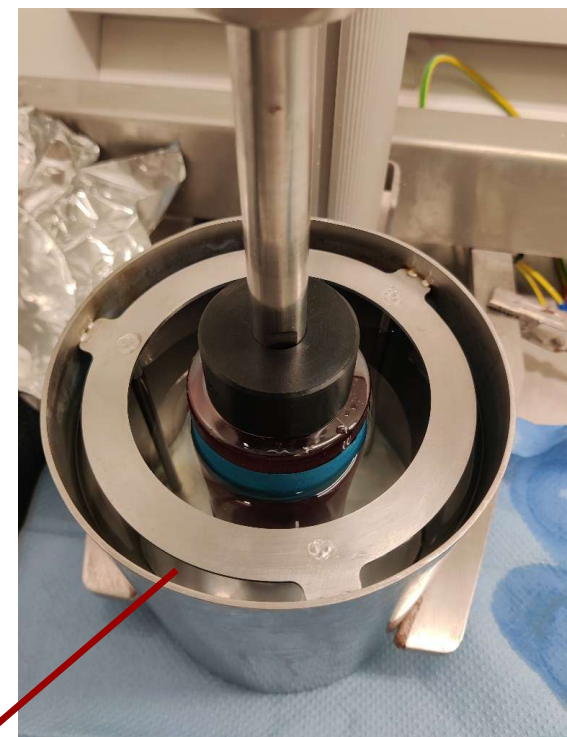
Lab-scale exposure



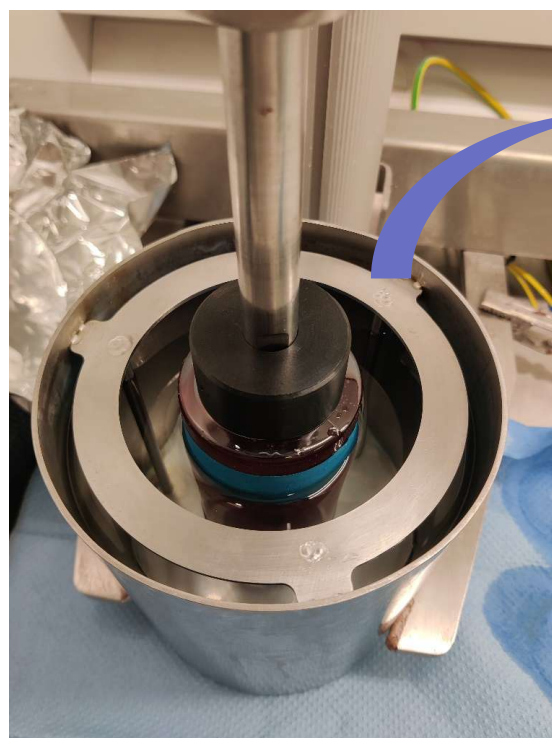
300L



2.2 L

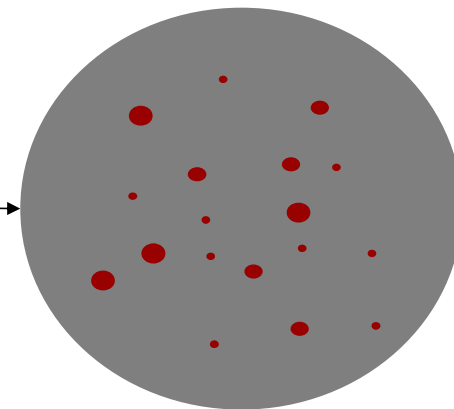
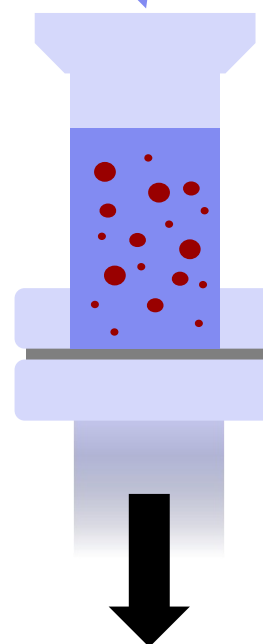


Microplastic analysis

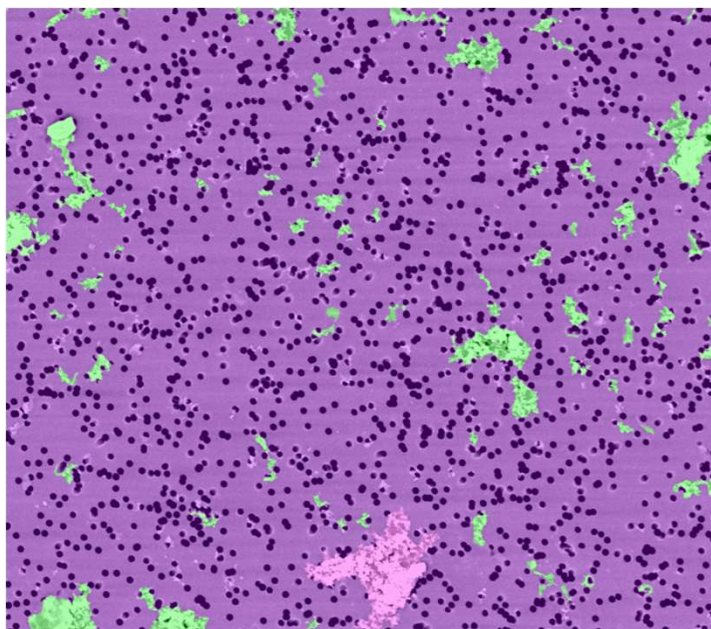
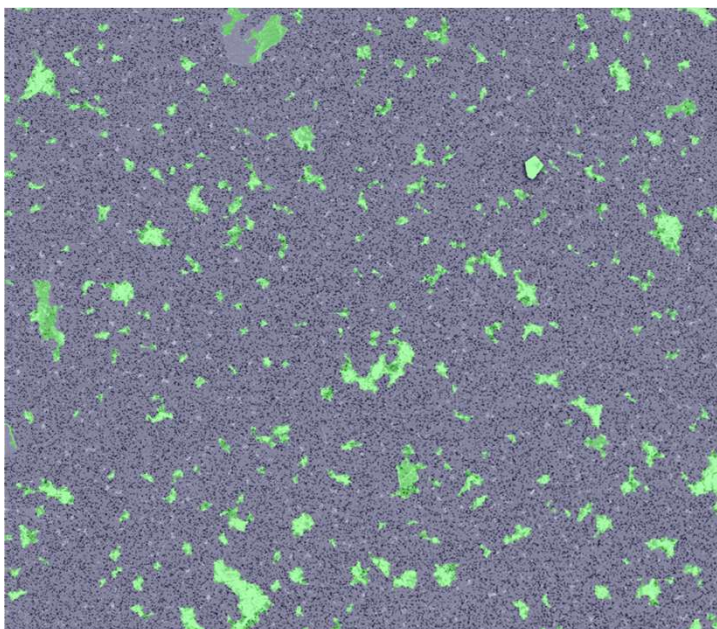


Dynamic exposure
(2+ weeks)

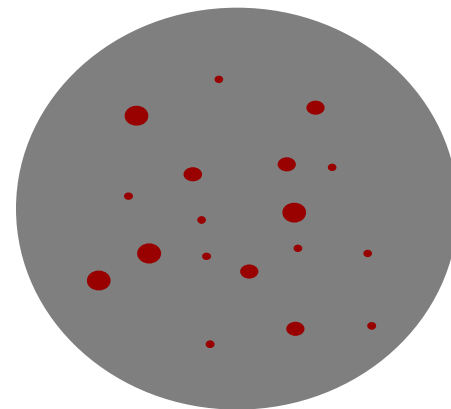
5-15 mL



Microplastic analysis



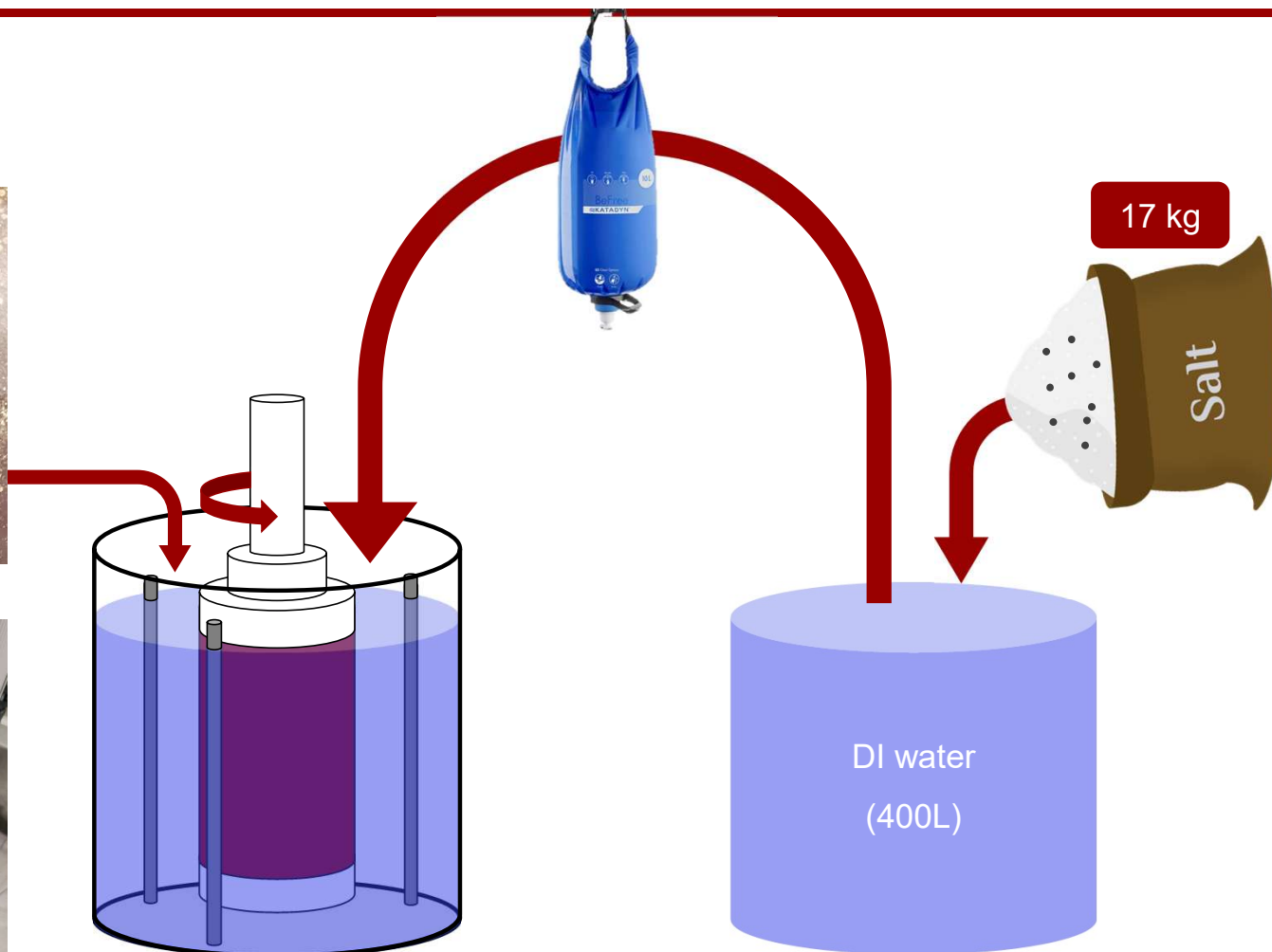
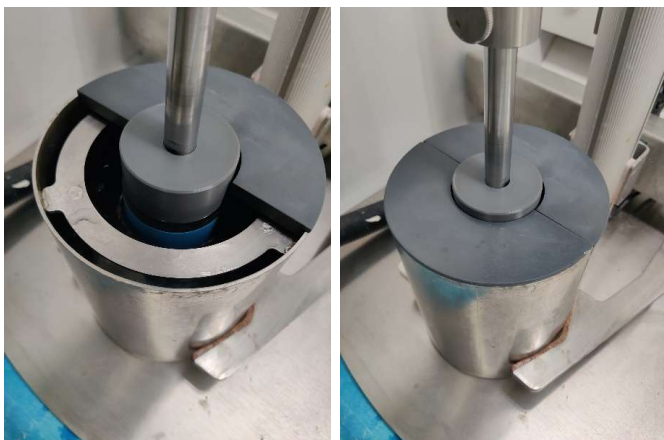
SEM particle analysis



Contaminants



Dust



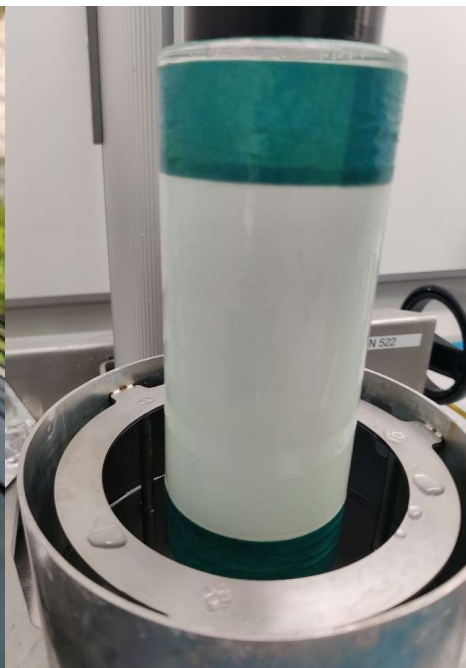
Samples



Si-Acrylate based
SPC

Fresh

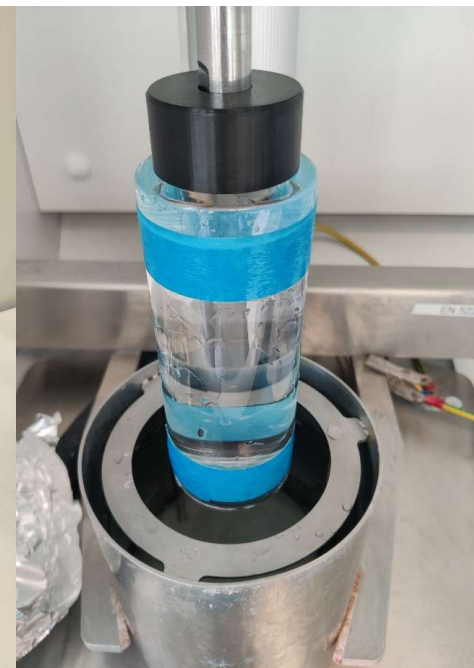
Pre-
leached



Rosin based
CDP

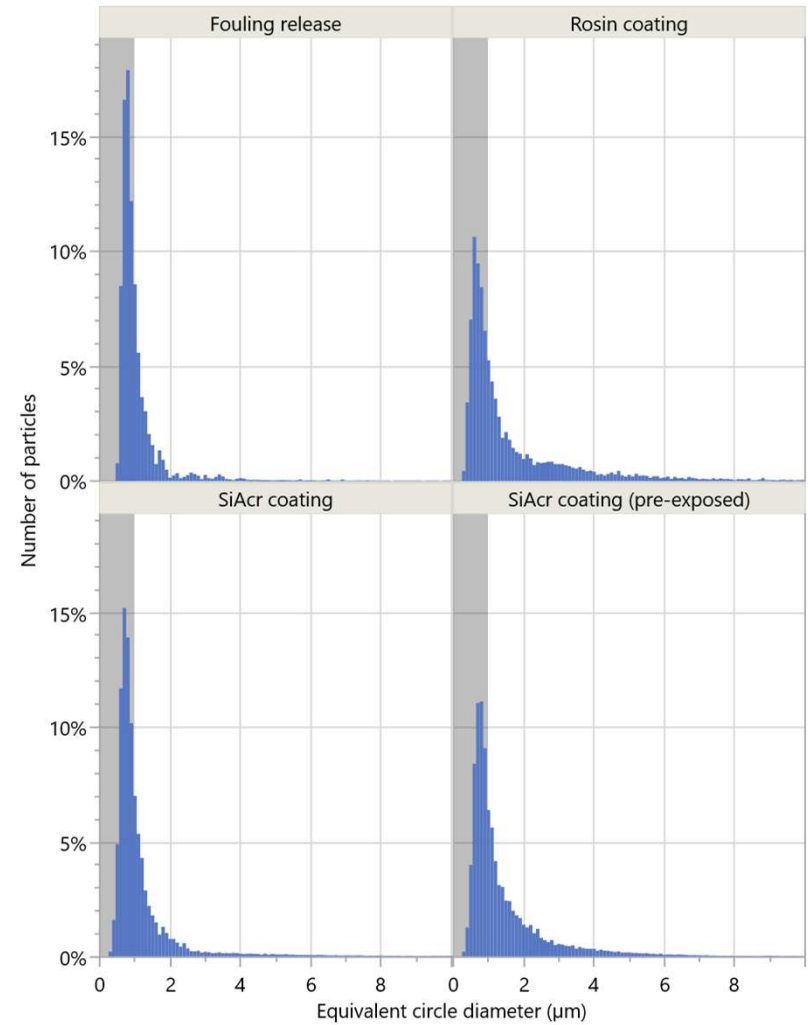
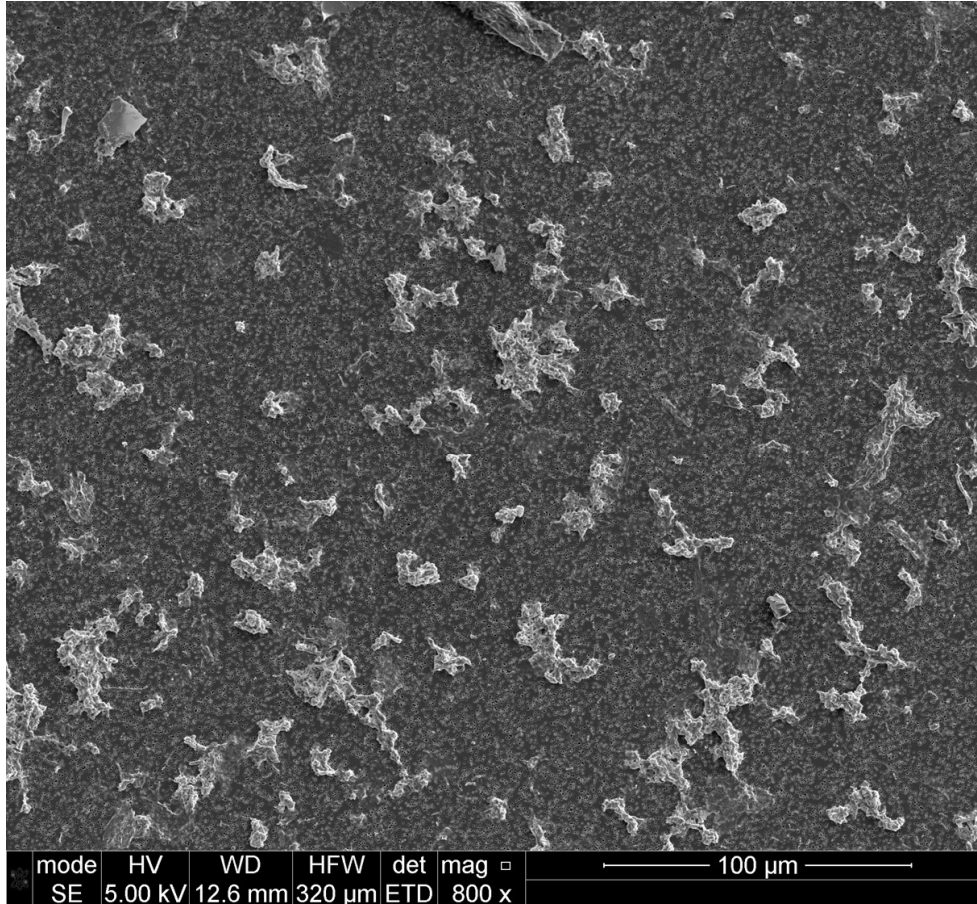


PDMS based
FRC

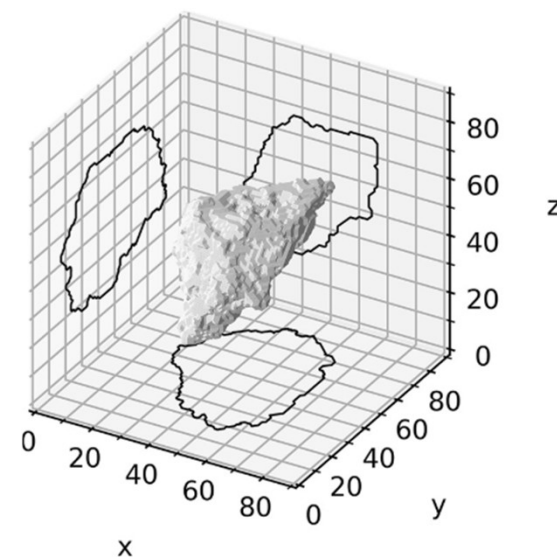
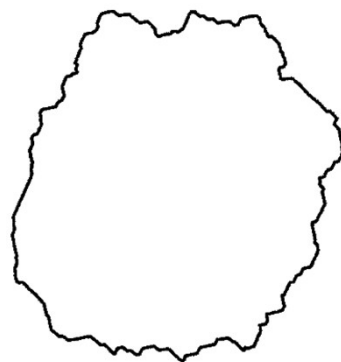
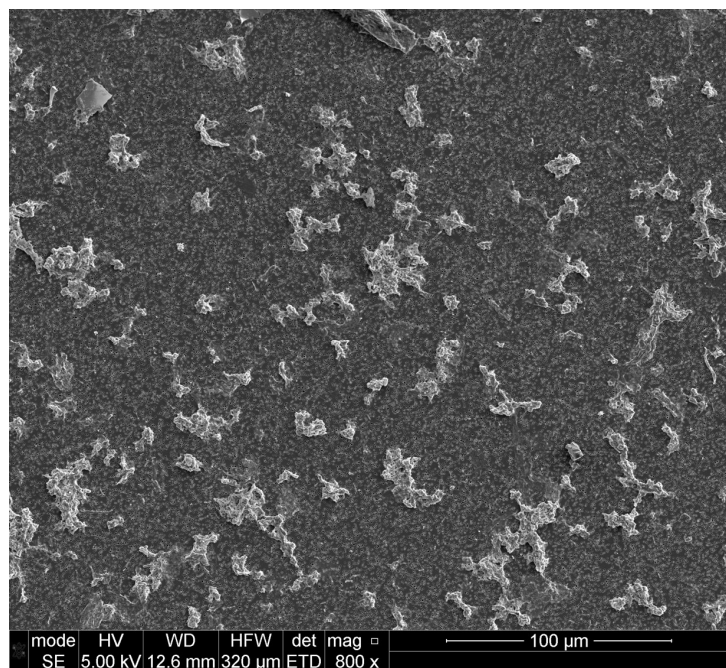


No coating
Control

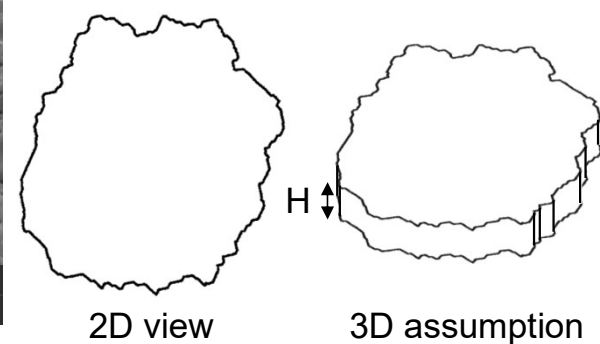
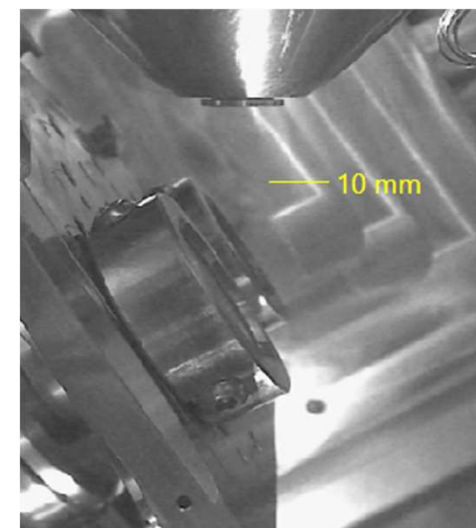
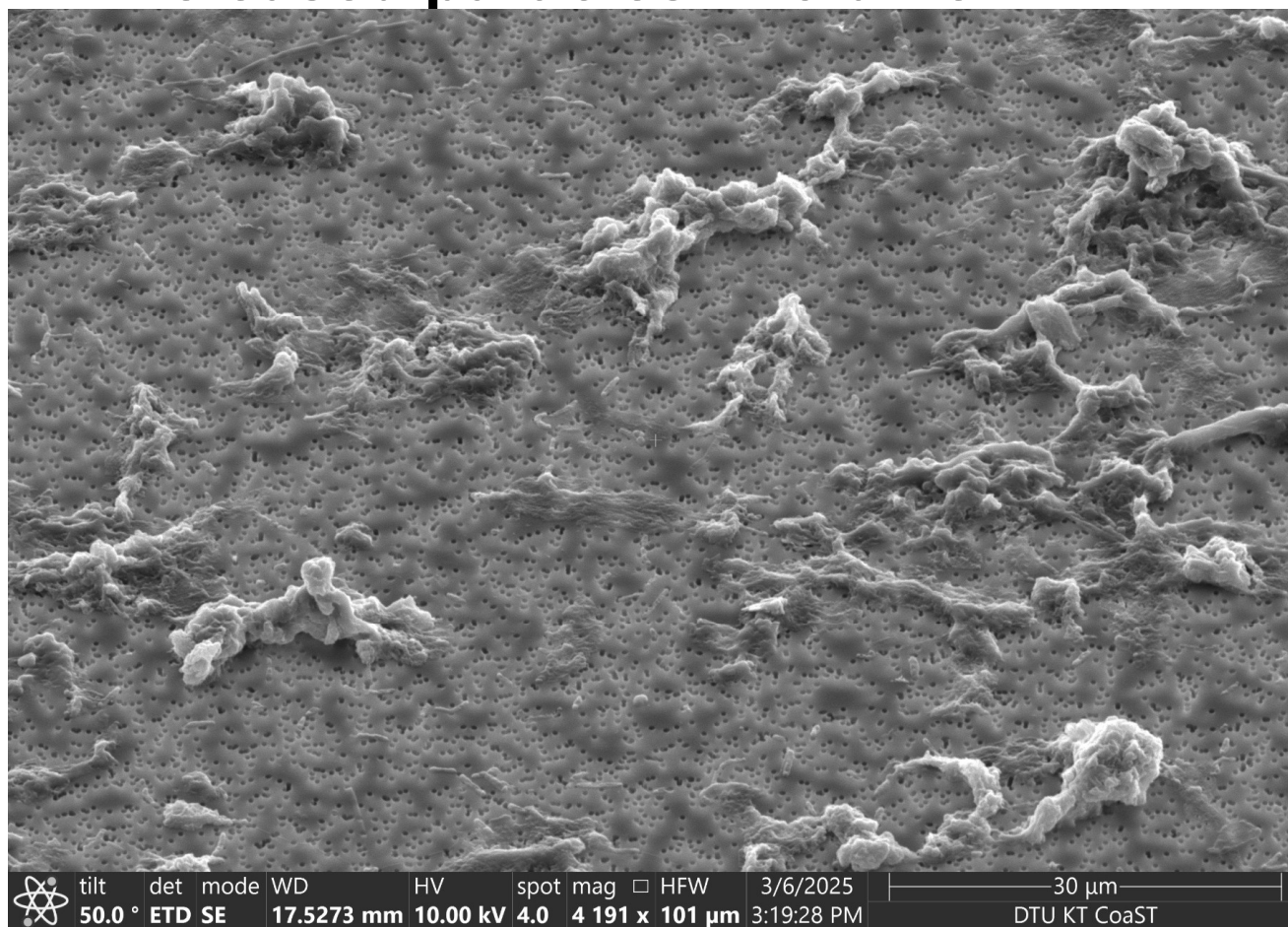
Released particles - size



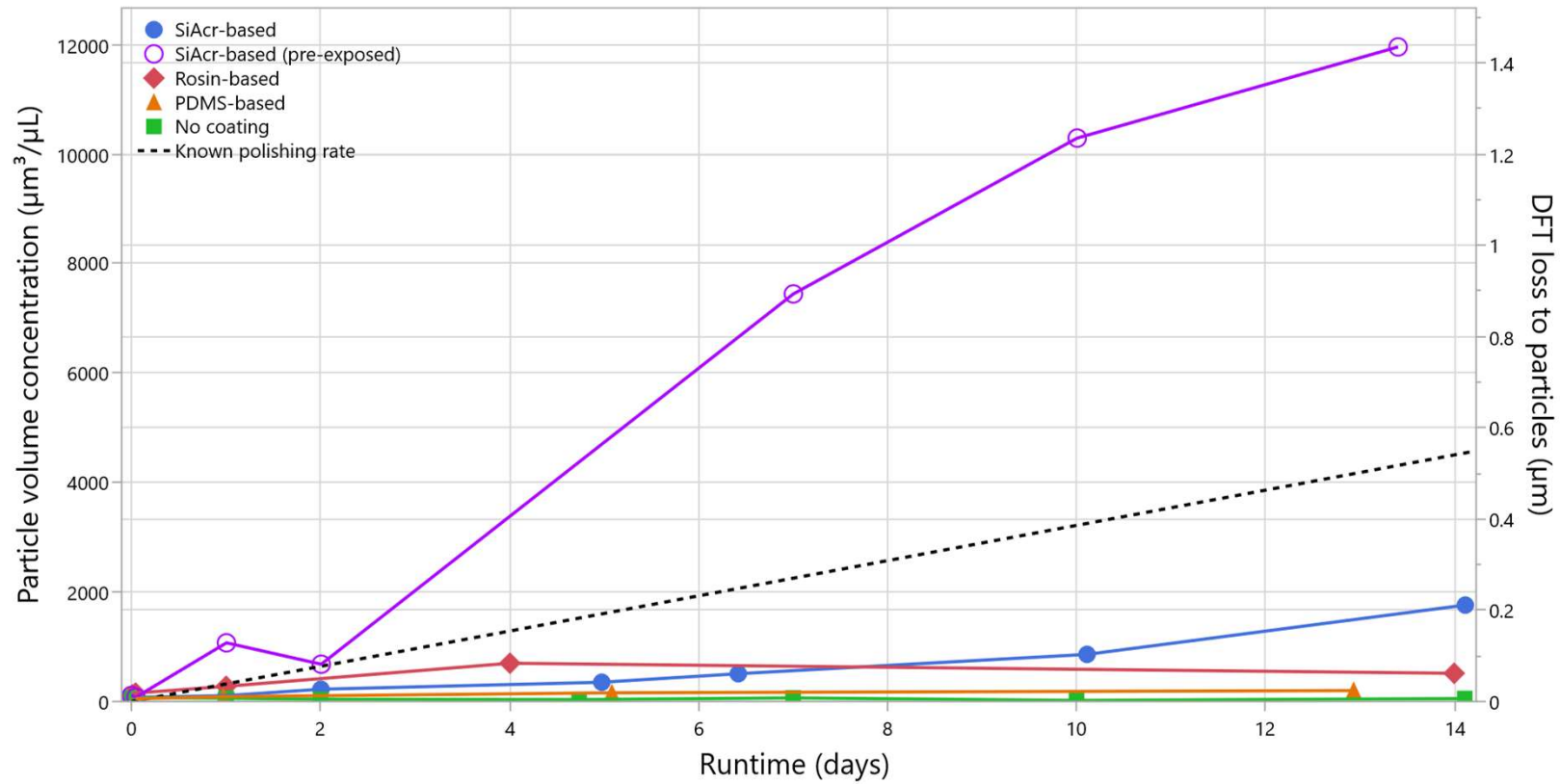
Released particles - volume



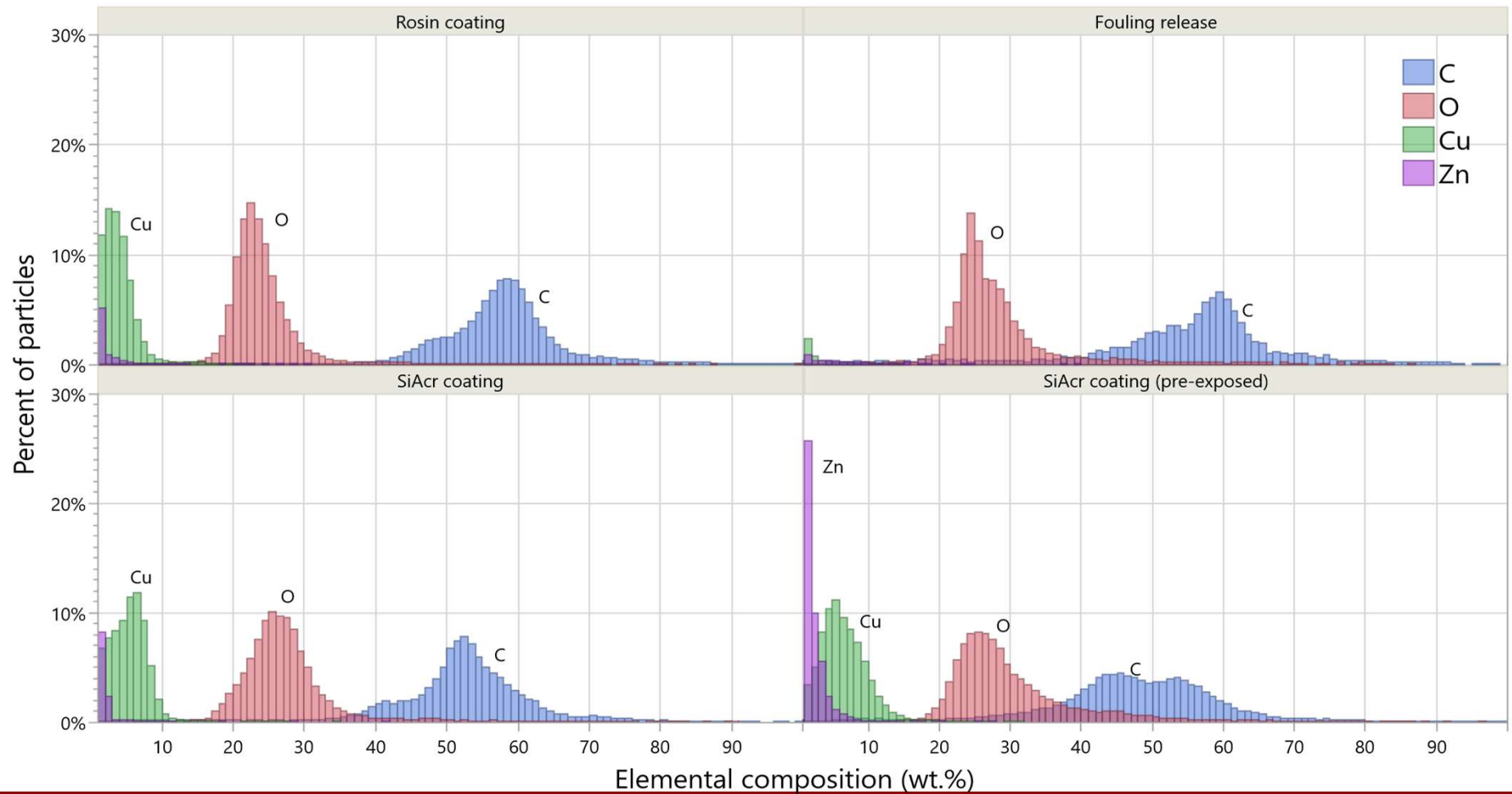
Released particles - volume



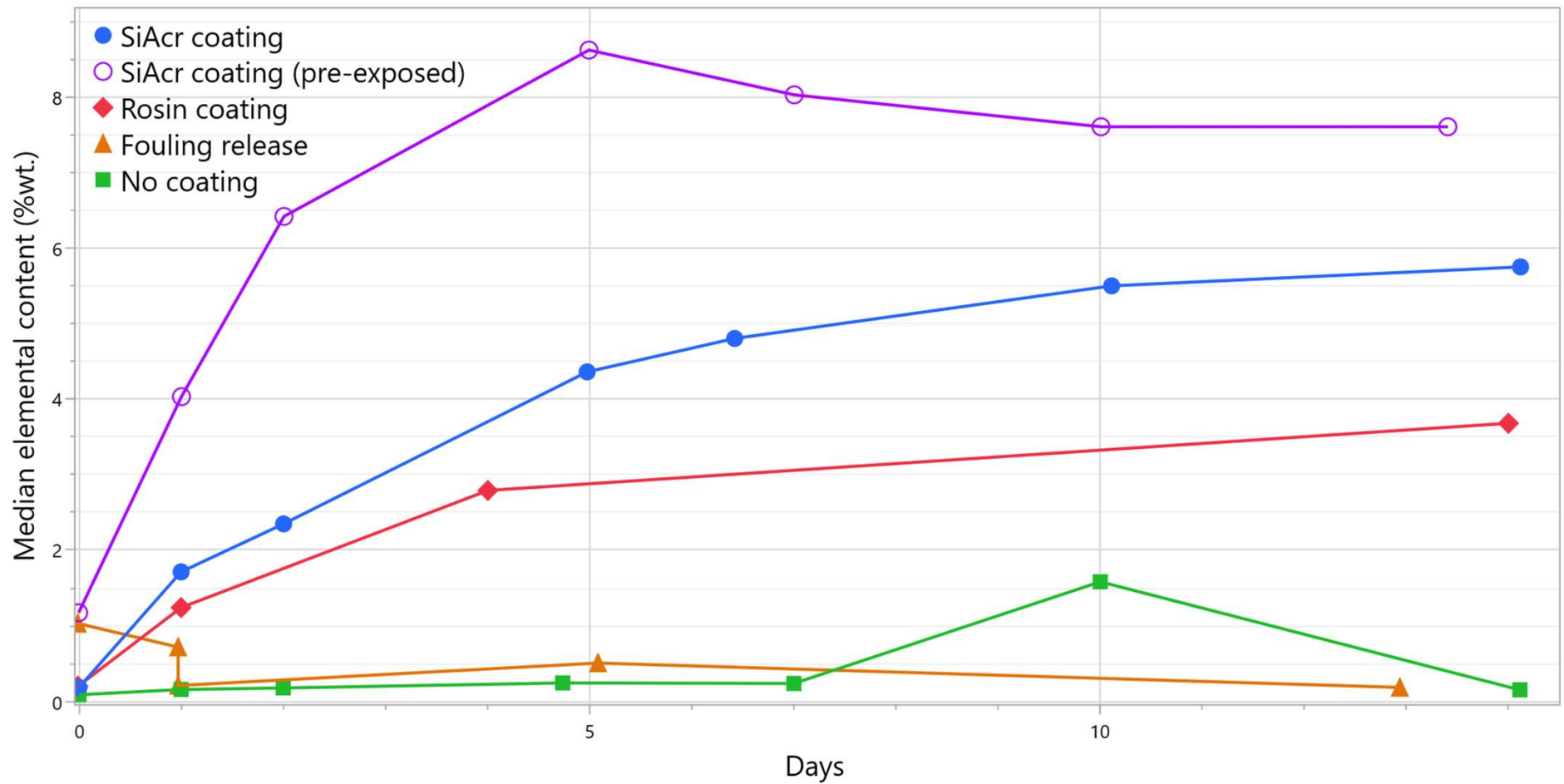
Released particles - volume



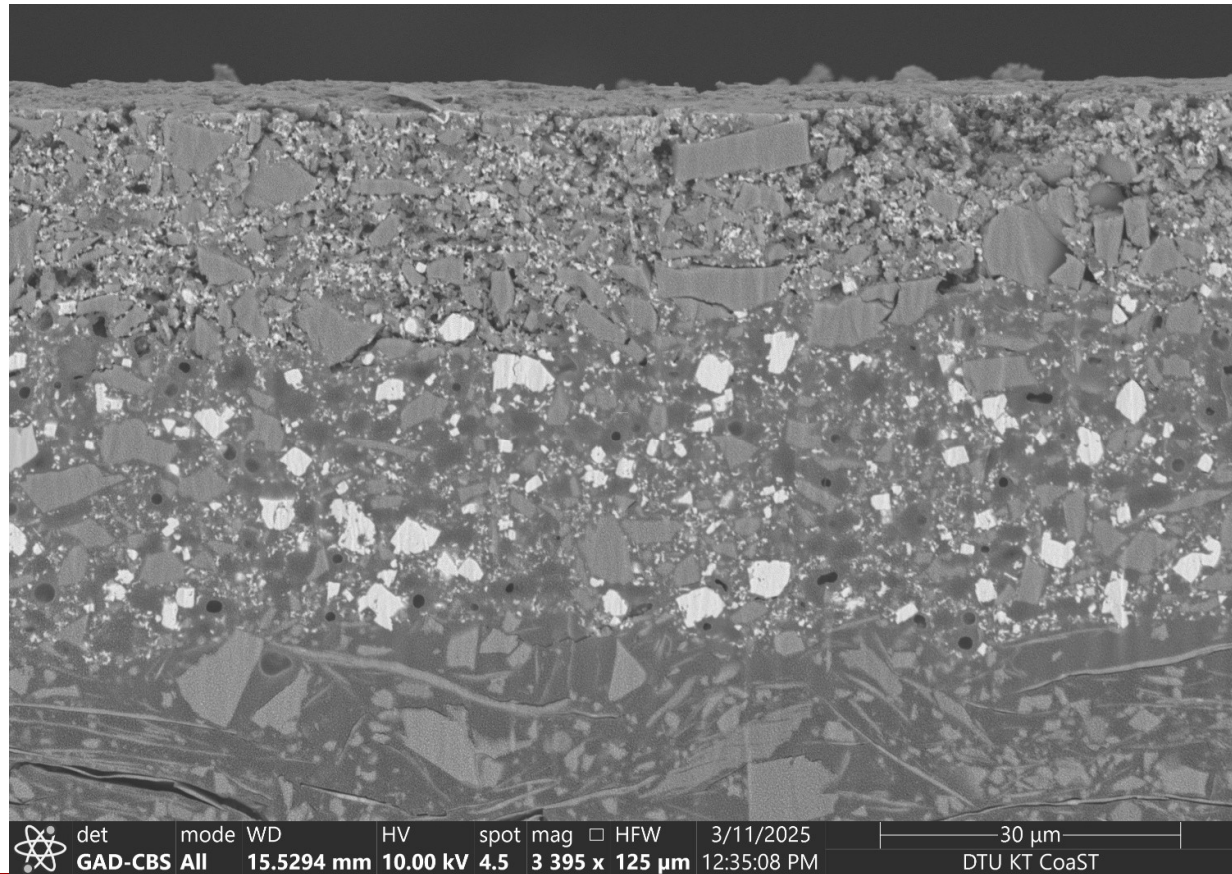
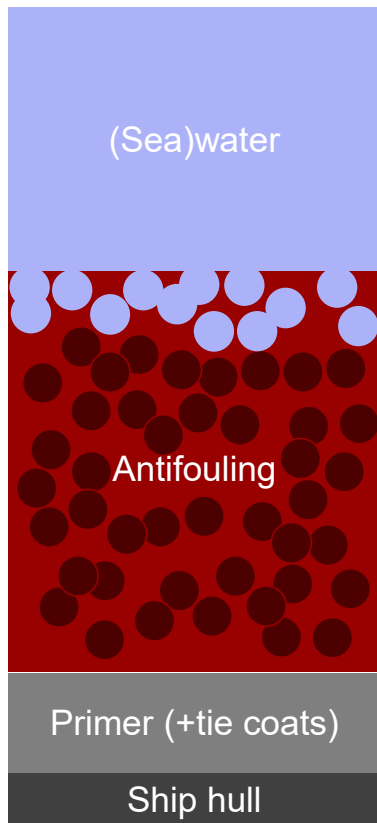
Released particles - composition



Released particles – Cu content

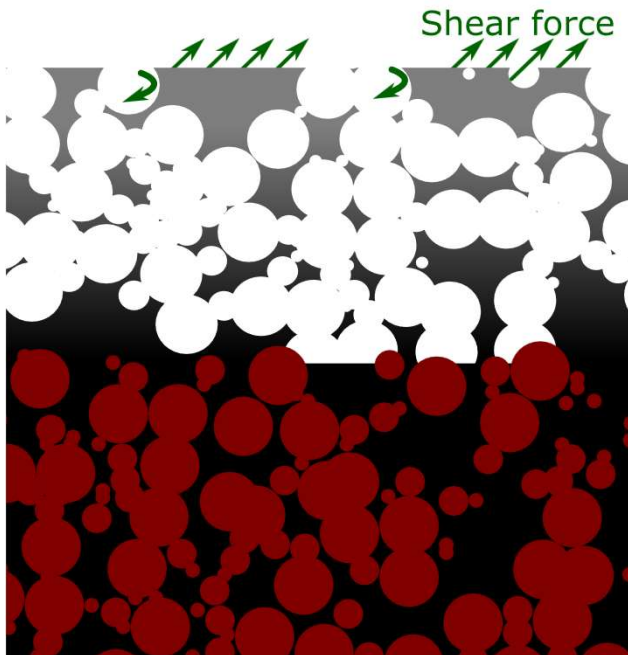


Conclusions

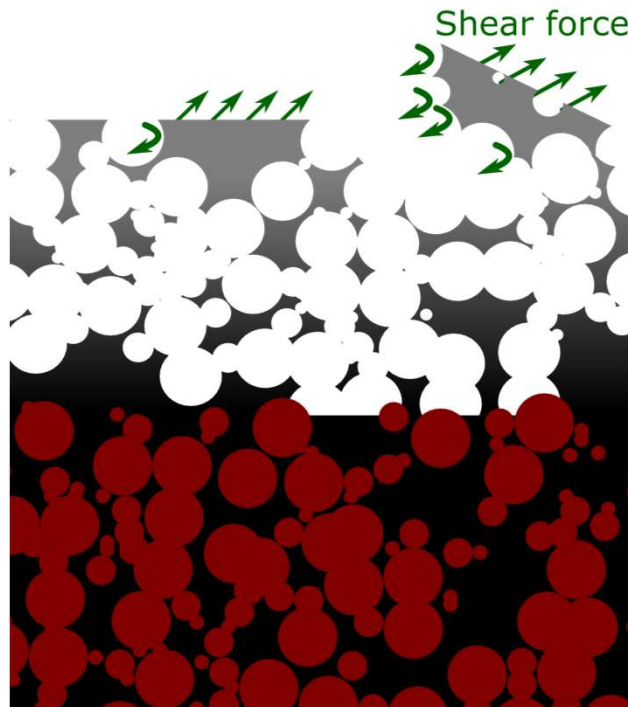


Conclusions

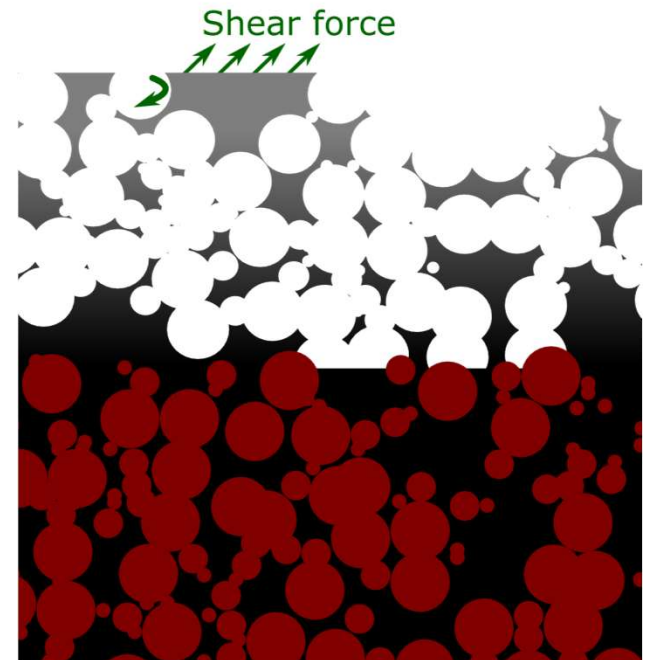
Direction of flow →



Direction of flow →

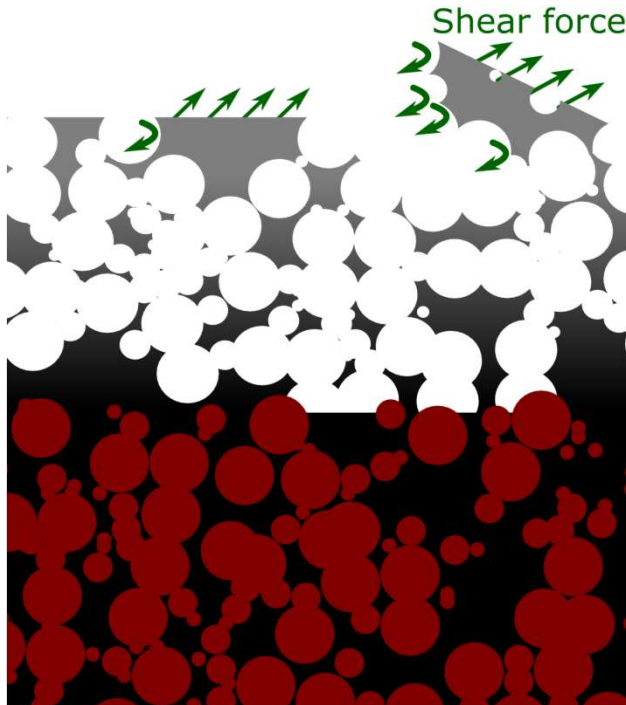


Direction of flow →



Conclusions

Direction of flow →



Polishing coatings
release particles

More polishing =
more particles

Released particles
contain biocides

Thank you for your attention!