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Analysis of micro and nano plastic particles on porous filter cascade systems

In the last years the research on micro and nanoplastic (NMP) particles in water and in air is growing very fast. Routines for analysis of microparticles in the range of 100 to 10 µm are very well stablished form particle analysis to mass spectroscopy [1]. Current efforts are focused in the submicrometer to nanometer range down to few tens of nanometer [2].
In this work we present an novel filtration system for micro and nanoparticles using a cascade stack with two different filter membrane. The frist filter with large pores (with diameter down to 1 µm) is produced by laser drilling or chemical etching. The second filter is fabricated by chemical etching of Al_2O_3 and can be used for filtration of particles down to few tens of nanometers [3]. The selectivity can be adjusted in principle trough the filter porosity. The main advantage of our filter system is the flexibility to be used by both scientific communities, first one working in mass spectrometry and the second one in particle analytics. Especially the second community is interested in the number of particles in size fractions, the overall size distribution as well as the chemical composition. Moreover, both materials, Si and Al_2O_3 are very well suited for many analytical NMP applications like µ-Raman spectroscopy, SEM AFM, AFM-Raman or other nanoanalytical instrumentations.
As an example, we present here the latest results on NMP particle identification using Raman spectroscopy of two model materials, PET and PS. PET reference NMP material is prepared by cryo milling with an average particle size of 22 µm, PS particles are monodisperse with mean diameter of 140 nm.

References

[1] Bauer, J., et al. (2019). Microplastic detection and analysis in water samples. IC SEWEN19, Quatar, Springer nature
[2] P.-T.Miclea, S. Richter, C. Hagendorf, Size-selective nano and micro plastic particle analysis on nano-porous membrane filter cascades, *Appl. Res.*, (2022), submitted
[3] SmartMembranes (2020). "SmartPor: Nanoporous Alumina." from http://www.smartmembranes.de/en/products/nanoporous-alumina/

Figures

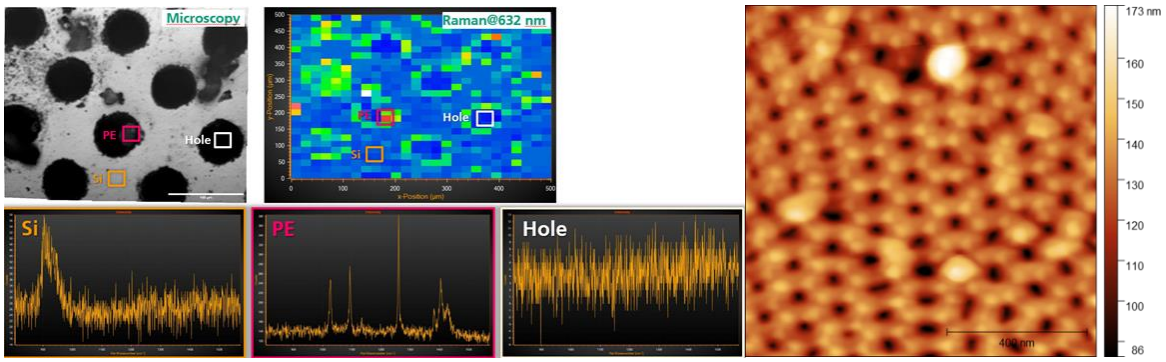

Figure 1: PE microparticles on Si Filter with pore size og 50 µm (left) and AFM image of PS and PE nanoparticles on Al2O3 Filter with pore size of 90 nm (right)