Supporting Information

Reactivity of Oxidized Polonium Towards Quartz and α-Al_2O_3 Surfaces

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Technical specifications

- ^{206}Pb-Targets: PbS, area density of Pb ≈ 350 µg/cm^2 or ≈ 440 µg/cm^2, enrichment 99.51%.
- Dimensions quartz glass and α-Al_2O_3 tubes: outer diameter 6 mm, inner diameter 4 mm, length 90 cm (supplier quartz glass: SCHOTT Quartz Glass GmbH, supplier α-Al_2O_3: KYOCERA Fineceramics Europe GmbH).
- Tube furnaces: Heraeus Hanau, type B/A 1,7/10, maximum temperature 900-1200 °C.
- Gas purification cartridges: Spectromol Oxysorb® and Hydrosorb®, Agilent Technologies Big Moisture Trap (Model BMT-4), Agilent Technologies Big Oxygen Trap (Model BMT-4).
- Mass flow controllers: MKS, legacy mass flow meter.
- Mass flow meter: Merck, Aalborg Digital Mass Flow Meter.
- HPGe-Detector: ORTEC, GMX20P4-70.
- Wall thickness of the lead collimator for γ ray measurements of the α-Al_2O_3 columns: sides 7 cm, front 1 cm.
- Thermocouple and read-out unit: Type K; Omega HH801B.

Additional experimental specifications

Table S1 *Temperature of the catcher foil during the experiment ($T_{catcher}$), catcher material, as well as irradiation (t_{irr}) and cooling (t_{cool}) time of the catcher foil and the experiment time (t_{exp}) for each conducted experiment.*

Experiment	Catcher material	$T_{catcher}$ / °C	t_{irr} / h	t_{cool} / h	t_{exp} / min
$H2O_{Q1}$	Ti	850 ± 20	14	1	104
$O2_{Q1}$	C	400 ± 30	8	0.5	60
$O2_{Q1}$ II	Ti	850 ± 20	14	3.5	105
$O2_{Q1}$ III	C	730 ± 20	14	1	61
$H2O/O2_{Q1}$	Ti	790 ± 20	12	1	60
He_{Al2O3}	C	360 ± 10	14	1.5	60

Microscope images of quartz glass and α-Al_2O_3

To study the surface roughness, quartz glass and α-Al_2O_3 plates (about 1 cm x 1 cm) made from the same material as the chromatography columns and from the same supplier where used. The surface roughness measurements were conducted with a KEYENCE VK-X3000 Series Confocal Laser Scanning Microscope (CLSM). A 100× magnification objective was employed, capturing surface topography over a measurement area of 144.7 µm × 108.5 µm. Prior to roughness parameter evaluation, the acquired topographical data underwent preprocessing, including mean plane subtraction to correct for sample tilt and ensure accurate surface height distribution analysis.

The average roughness R_a and the areal average roughness S_a were extracted from the processed data to quantitatively characterize the surface morphology. Fig. S1 and Fig. S2 show the images, as well as the height profiles taken of the quartz and the α-Al_2O_3 surface at two measurement points. The extracted surface parameters are listed in Table S2.

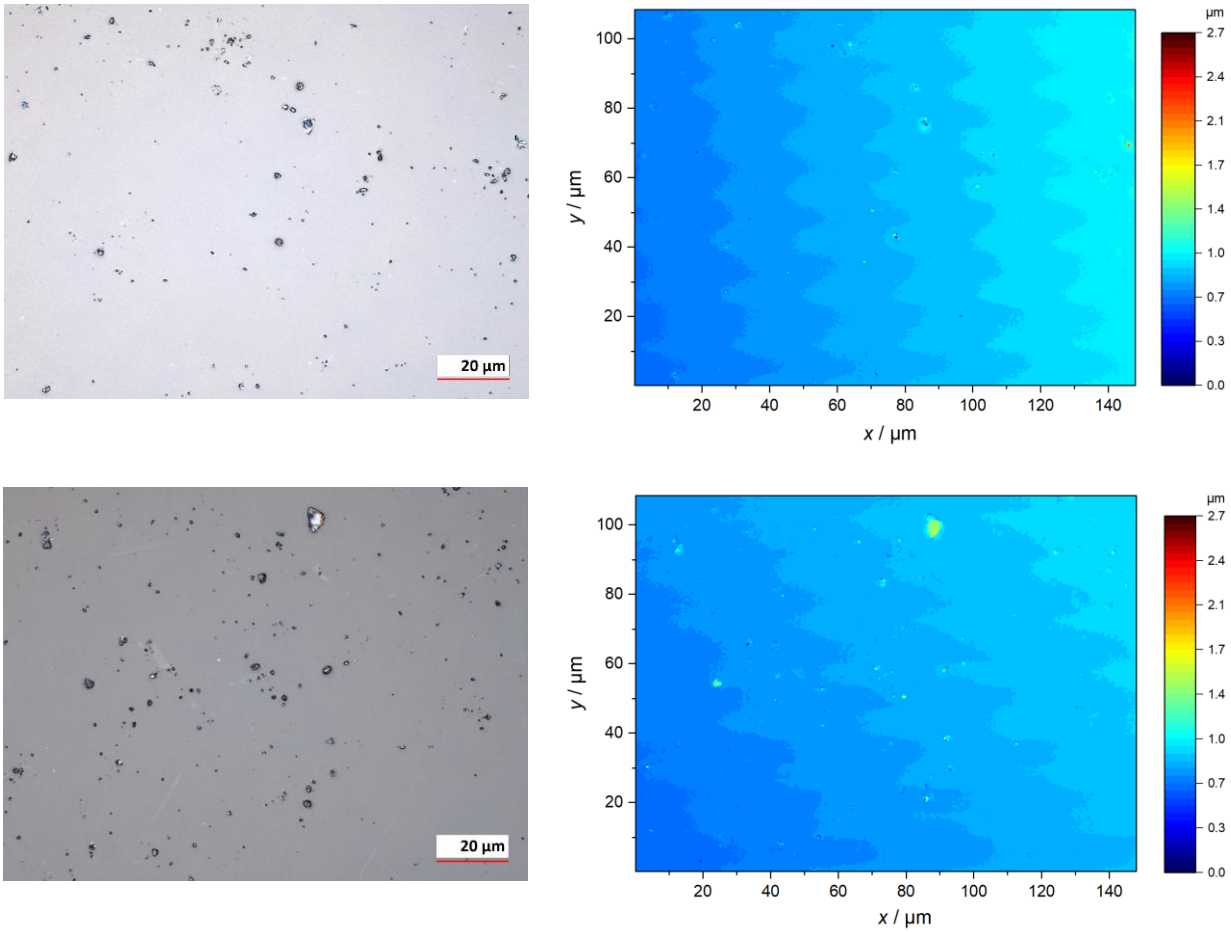

Fig. S1: *Laser scanning microscope images of two measurement points on the quartz surface (left) and the corresponding height image (right).*

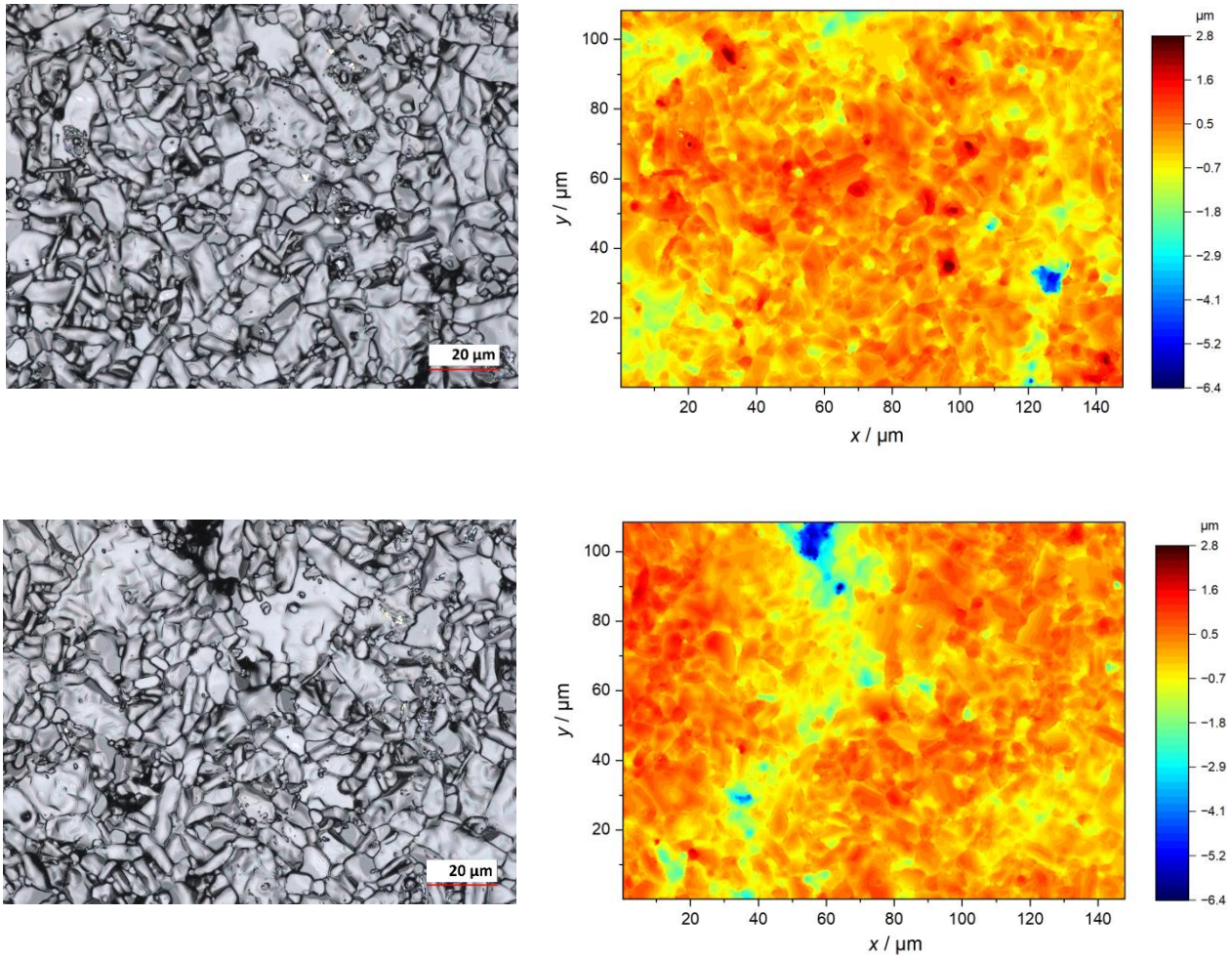

Fig. S2: *Laser scanning microscope images of two measurement points on the α-Al_2O_3 surface (left) and the corresponding height image (right).*

Table S2 *Mean roughness parameters R_a and S_a determined with laser scanning microscopy for quartz glass and α-Al_2O_3.*

Surface	R_a / µm	S_a / µm
Quartz glass	0.0070 ± 0.0003	0.0080 ± 0.0003
α-Al_2O_3	0.41 ± 0.02	0.429 ± 0.001