Aluminising Report

Project name	Aluminising of Nordic Optical Telescope mirrors M1 and M2
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The Mirrors were delivered to WHT shortly before end of working day on 7 May 2023, some 5 hours later than expected. Due to the significant delay and prevailing storm conditions, processing was postponed until the next day. It eventually started about 10.30 a.m. following alignment checks on NOT mirror cell.

The removal of the old coating of Aluminium proceeded as normal, by the usual method of caustic solution, treating persistent droplets locally with acid. However, there was then an unusual delay in drying the surface of M1, with incomplete evaporation of the alcohol all over, which affected the subsequent polishing stage. This was judged due to the high humidity (60%) in the dome area. We opted to repeat purging the surface humidity, using ethanol, after which the polishing proceeded more typically, and a smooth clean finish was obtained. Note that extra effort was also required to dry the underneath of the substrate.

These difficulties led to a further one-hour delay in loading the mirror. Loose dust was removed from M1 using an air gun inside the tank, where M2 received a final polishing, just before closing.

Thus vacuum pumping was started at 14.30, and coating was carried out by 17.00 following the standard procedure with optimal efficiency. The tank was partially vented at 19.00 and left overnight, as standard.

At 9.30 a.m. on the 8th the tank was opened, with the client present, and the new coatings were inspected and measured. Several long and roughly parallel scratches on one side of M1, identified in the old coating, were again visible. Other minor scratches also visible. A backlit inspection of M2 showed variations in the concentration of pinholes, but all of the aforementioned features are normal. A defect of about 1 cm^2, resembling excess aluminium but apparently flush with the coating, was found near the centre of M2. Apart from these details, the surface finishes appeared uniform and high quality on both mirrors.

Reflectivity and Dust Index was measured on 2 locations on M1 using the OPO CT7 instrument. The readings are given overleaf and comparisons with average values from recent and older aluminisations are discussed.

Reflectivity and Scattering measurements on Newly Aluminized NOT Primary 2.5 m mirror

in 7 wavebands, using CT7 Coating Monitor.

Measured at 2 locations, on opposite sides, near outer edge, avoiding scratches.

No measurements taken on secondary mirror, assumed similar.

DATE	surface	REFLECTIVITY (%) MEASUREMENT						
	Waveband (nm) →	365	404	464	522	624	760	970
2023/06/08 09:40	NOT M1	93.15	91.84	90.22	90.82	90.38	87.40	93.60
2023/06/08 09:43	NOT M1	93.27	91.68	90.12	90.86	90.40	87.49	93.42
Comparison with recent and older Aluminizations:								
2023/05	MT1.2	92.75	91.13	89.84	90.93	90.30	87.72	93.33
Diff(NOT M1 - MT1.2)		0.52	0.55	0.28	-0.07	0.10	-0.23	0.09
Aluminized Values, pre-upgrade								
2020/03	WHT M1	92.90	91.30	90.90	90.90	89.90	87.00	92.80
2019	Average 4 Alums	93.78	91.96	91.15	91.13	90.13	87.56	93.88
range before CT7 upgrade		0.88	0.66	0.25	0.22	0.22	0.56	1.08
error bars (half-range)		0.44	0.33	0.13	0.11	0.11	0.28	0.54
Diff (NOT M1 – Avg 2019)		-0.63	-0.12	-0.93	-0.31	0.25	-0.16	-0.28
Calibration measurements								
2023/06		84.80	84.10	87.30	90.80	90.10	84.00	86.70
2023/04		84.50	83.60	87.40	90.90	89.70	83.70	86.70
2021/10		84.3	83.4	88.2	90.2	89.1	82.8	85.9
Diff (2023/06 – 2021)		0.5	0.7	-0.9	0.6	1.0	1.2	0.8
Scattering measurements		**Dust Index (%)**						
2023/06/08 09:40	NOT M1	1.10	1.00	1.10	1.00	0.90	1.00	0.90
2023/06/08 09:43	NOT M1	1.50	1.50	1.80	1.50	1.30	1.50	1.20
2020/03	WHT M1 Alum	2.40	2.20	2.10	1.50	1.50	1.00	1.00

Conclusions:

The reflectivity result is close to range of variations observed in previous aluminizations, except in 464 nm waveband. See Graph on next page.

However, reference mirror readings are also anomalously low at 464 nm (highlighted) in all tests in 2023. This seems likely due to the CT7 upgrade and refurbishment in 2022. New %R data are given to 2 decimals.

The NOT reflectivity is 0.5% higher than recent aluminisation and WHT alum in 2020.

Scattering is minimal, indicating high quality finish of substrate, scratches notwithstanding.

Graph showing recent measurements are mostly within range of older aluminisations, except at 464 nm. The smoothed line was added to make the absorption band more obvious; it does not imply real measurements, which are taken at discrete wavebands.