

FLORIS CONTRACT CHANGE NOTICE



Contractor: Ustav fyziky plazmatu AV CR, v.v.i. (Institute of Plasma Physics of the CAS)

Contract N°: M056CO18112002

ECP/ CCN Reference: FLX-CCN-TOP-TEL-0013

Date:22.06.2022

Title

Update of the RFA – Bonding qualification process

Class:

A

Description of change

The FLEX FLORIS Telescope consists of five lenses – two lenses are made from CaF₂ (L1, L2), two are made from K5G20 (L3, L5) and one is made from N-KZFS8. To ensure optical stability and shock durability of the lenses, each lens holds its position inside the telescope via glue interface to its aluminum ring.

With respect to the signed RFA - Adhesive Bonding Qualification (i.e. FLX-RA-MCS-TEL-0003 rev.3), the scope of work has been expanded by adding tensile testing coupons, i.e. FLX-RA-MCS-TEL-0003 rev.5).

Reason for change

The objective of the bonding process update is to guarantee that the bonding process is under control given its complexity, i.e. validation of the process. The detailed description on the bonding process qualification can be found within the qualification plan.: FLX-PL-TOP-TEL-0004 Rev. 13.

The reason for change of the RFA is due to exceptional mutations of RFA Part1 needed to overcome the exceptionally challenging development of the bonding procedure, qualification process, and configuration of the qualification samples. The reason for the change was triggered by the delamination observed on the trial samples for NKZFS8 (ref. NC-0045) and the reometric test results by ESA that the adhesive performs with higher-than-expected stiffness after curing. A thermoelastic analysis of the original bonding qualification sample design using the updated stiffness data after NC-0029 confirmed the behavior observed with the NKZFS8 trial samples (FLX-HO-MCS-TEL-0048, 15.2.2022).

Tensile test will be performed on rounded samples glued to its aluminum counterpart. In such a way, stresses that are applied within lens gluing setup will be maintained. The change incorporated additional tensile testing coupons (tensile strength verification) within the following configuration:

- **Lens material:**
 - material samples: CaF₂, NKZFS8, K5G20,
 - the size of the samples will be Ø25 x 10 mm (actual thickness may vary), polished on the one flat side of the sample
 - cleaned with Acetone + than primed with DC1200 (drying of primer 2 hours),
- **Lens holder:**
 - bare aluminium 6061-T6511, surface roughness Ra=1,6
 - cleaned with Acetone + than primed with DC1200 (drying of primer 2 hours),
- **Glue application:**
 - 93-500 space grade,

- vacuum after 2-component mixing to remove air bubbles:
 - wait >6min until majority of bubbles collapsed,
 - measurement scale accuracy 0.01g,

Second part of the aluminum sample is bonded using epoxy Loctite EA 3430 (see the following picture).



Figure 1: Tensile coupons test setup: Aluminum rod (Al6061) vs. 0.5mm 93-500 DS vs. glass/crystal-epoxy glue vs. aluminum (not specified) rod

Tensile test coupons test matrix:

	L4	L1/L2	L3	L5
	NKZFS8 + AL6061 T6511 (cured 20hrs @ 50°C)	CaF2 + AL6061 T6511 (cured 7 days at RT (20°C))	K5G20 + AL6061 T6511 (cured 20hrs @ 50°C)	K5G20 + AL6061 T6511 (cured 7 days at RT (20°C))
Tensile test	5 samples	5 samples	5 samples	5 samples
Thermal cycling + Tensile test	5 samples	5 samples	5 samples	5 samples
Ageing + Thermal cycling + Tensile test	5 samples	5 samples	5 samples	5 samples
Lap-shear test	2 samples	2 samples	2 samples	2 samples

Price breakdown (currency) / Price-level in FFP

- Bonding qualification campaign update for tensile test coupon campaign – 29.122,- EUR
- Toptec considering 3203, - EUR as own contribution
- **Toptec considers 25.919, - EUR to Micos as Class A**

The payment plan is connected with close-out of the following milestone:

- MIC MCS-CCN-0008 for successful delivery of bonding process qualification report by 21.10.2022

Effect on other contract provisions

- none -

Start of work: 05/2022

End of work: 11/2022

CONTRACTOR: Institute of Plasma Physics of the CAS (TOPTEC)	
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