Subject: E1400330-v1, Waiver for another RGA scan of the OMC Breadboard Assy, ASSY-D1201439-3
From: Dennis Coyne <coyne@ligo.caltech.edu>
Date: 7/14/2014 2:57 PM
To: Koji Arai <karai@caltech.edu>

LIGO-E1400330-v1
Waiver for another RGA scan of the OMC Breadboard Assy, ASSY-D1201439-3

The aLIGO OMC breadboard Assembly (D1201439-v2) for the 3rd IFO was recently cleaned and vacuum baked (ICS Bake-7446). The RGA scan associated with this vacuum bake was approved. Subsequently the EP30-2 adhesively bonded beam dump joints were found to be somewhat debonded, likely as a result of differential thermal expansion. Since debonding and rework of the OMC breadboard assy would risk damage to the OMC optics it was decided to stake the beam dumps by adding EP30-2 adhesive along their perimeter interface with the OMC breadboard. This was done and was successful; The beam dumps appear to be more firmly attached. Note that the room temperature cure of the EP30-2 adhesive is a permitted cure cycle.

Koji Arai has requested a waiver for a second vacuum bake and/or RGA scan of the OMC assembly for the aLIGO 3rd IFO. The reasons for a waiver are as follows:

1. exposure to additional handling adds risk to this sensitive optical assembly
2. another optical performance test would be required subsequent to another vacuum bake & RGA scan (more work & risk)
3. a bake adds risk that differential stress will cause debonding (as it already has done for some of the beam dumps). Even if an elevated temperature bake is not conducted for the purpose of curing the adhesive (or reducing its outgas rate), as a practical matter at least a low temperature bake is required to drive water off in a reasonable amount of time.

The only risk that another RGA scan might catch is that the added EP30-2 adhesive is a significant hydrocarbon outgas load. The "flag" hydrocarbon AMUs outgassing rate for EP30-2 adhesive which has been room temperature cured is 5.0E-13 Torr-L/s/cm^2 according to E1000386-v1. So for the OMC's 3 cm^2 adhesive area the HC outgas rate is 1.5E-12 Torr-L/s. The hydrocarbon pumping rate is Sc~6800 L/s for the corner station (reference E0900398-v5). So the OMC EP30-2 adhesive contributes ~2E-16 torr partial pressure for hydrocarbons.

The hydrocarbon partial pressure goal is Phc = 1 x 10^-13 Torr (reference T1301006-v2). There are many other contributors to the HC partial pressure, so of course not all of the budget can be given to the OMC adhesive. In document T040001-v1, an allocation of 7.4E-14 torr (HC flags) is given to ISC in the corner station. Since the EP30-2 component of the OMC is less than 1/300th of this value, it is clearly acceptable if properly formulated, mixed and (room temperature) cured.

Given the very low risk of higher than expected hydrocarbon outgassing but the very real risk of potential damage to the assembly in going through another vacuum bake & RGA scan, I waiver the requirement for another RGA scan.

Dennis Coyne
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-------- Original Message --------

Subject: Amount of epoxy applied on the OMC beam dumps
Date: Mon, 14 Jul 2014 13:17:39 -0700
From: Koji Arai <karai@caltech.edu>
Reply-To: karai@caltech.edu
To: Dennis Coyne <coyne@ligo.caltech.edu>

Hi Dennis,

I estimated the amount of EP30-2 epoxy applied on the OMC beam dumps.
The volume of the applied glue is about 200mm^3.
The surface area is about 300 mm^2

I'm planning to ship the OMC to LHO by the end of this week.
I heard that Bob is not on campus till Thursday.
So, this means that I need to wait for
either
1) your waiver of the RGA scan
or
2) assistance of you or someone for the RGA scan

Here is the note for the calculation
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Photos of the applied epoxy can be found in the following link
http://nodus.ligo.caltech.edu:8080/OMC_Lab/201
The middle slidshow is easier to see.

The glue line has about 2mm both in width and hight.
Assume the crosssection of the glue is triangle.
The length of the glue is
- The edge length is ~20mm. I have four edges.
- Small amount of glue is applied at the three vertices of the V shape.
  So total 6 of 3mm long glue lines.

(2mm x 2mm / 2) x (4 x 20mm + 6 x 3mm) = 196 mm^3

Surface area
  2mm * sqrt(2) * (4 x 20 mm + 6 x 3mm)
+ (2mm x 2mm /2) * (4 x 2 + 6 x 2) = 317 mm^2

Koji