Minutes of the Core Optics Subgroup, 4/12/01

9 am PST US/Europe meeting

CIT: Jordan , Gari, Gary
MIT: David, Peter, Gregg
Glasgow: see Stanford
Stanford: Roger, Marty, Helena, Sheila, Jim
UF: Dave

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1) Coating Status (Gari, Helena, Jordan)

Jean-Marie Mackowsky visited CIT on Monday, 4/9 for discussions and the formulation of a technical workplan for coating studies at SMA-Virgo. (A preliminary version of the plan was formulated at the March LSC meeting; contact Jordan or Dave if you want to get a hold of it.) JMM thought the Q studies were doable; the reduction in absorption to the 0.1 ppm level or below will prove more challenging. But, SMA-Virgo is now claiming lower absorption than REO. Also, JMM proposed looking at using coating methods to compensate for sapphire inhomogeneities; they have previously been successful at correcting up to 0.2-0.3 waves of distortion by adjusting the thickness of the coating using masking techniques.

Gary is meeting with JMM and EGO/Virgo folks to finalize MOU and contracts this week.

CSIRO informed Gari that they have an ion beam chamber and are eager to do Advanced LIGO coatings. Gari informed them that initial contracts have already been signed.

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2) Sapphire polishing (Gari)

There are now many technical approaches (and different companies) to attack the sapphire inhomogeneity problem:

BFG – will try a compensating control polish only on side 2 of the sapphire substrate. They may or may not be able to do in-house metrology. LIGO requirements are about an order of magnitude greater than they have done in the past.

CSIRO – has three different approaches. First, compensating coating; this is an established technology for them. Second, ion beam etching of the surface; by adjusting dwell time of ion beam, they can selectively remove more or less material; a bit more speculative, but probably doable. Finally, they are proposing a novel fluid flow polishing technique (not sure about the details, but I guess they adjust flow rate (?) to selectively remove more or less material)

Kodak – they are proposing something, but not really clear they can do it.

SMA-Virgo – as noted above, coating compensation.

Crystal Systems – Jordan discussed with CSI the possibility of dealing with inhomogeneity problems during the growth phase. Does optical inhomogeneity depend on orientation? A-axis seems to be better than m-axis…

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3) Sapphire Absorption (Roger)

The Alexometer has been moved into a new lab and set up again. Currently, getting the performance back to previous best values. Stanford needs a high power laser (~ 10 W) to induce sufficient heating in coatings to see a signal. Dave R. will verify modal quality and then send the Lightwave 10 W laser (currently at LLO) to Stanford.

Hydrogen annealing of sapphire is underway at Stanford. An oven has been set up; should be better than CSI since Stanford's ovens are new and probably cleaner than CSIs.

A new batch of CSI sapphire will be sent to Stanford soon for absorption check.

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4) Q measurements (Sheila)

Q measurements on uncoated LIGO 1 optics have been performed. Lots of modes; three of them were found to be above 10^7. Bonding the ear attachments is tricky, but doable. Sheila will start to look at coated optics next.

David S. noted that one of Mackowsky's people formerly worked on Q measurements as a graduate student: "nanoidentology", highly spatialized localized probing of Young's modulus. He found that uncoated and coated surfaces had (surprisingly) the same stiffness.

Jordan reported that the first batch of substrates for the coating tests would arrive in a few months.

Gregg is setting up his apparatus at MIT.

Finally, a question arose about which SMA-V coating chamber to use for the Q studies. Since SMA-V is starting to ramp up for Virgo, working the Advanced LIGO test pieces into the large coating chamber schedule may prove problematic for meeting our deadlines. On the other hand, one would like to mimic as closely as possible the actual coating conditions for AdL substrates; the smaller coating chamber may not give the same results. In addition, there is a 4X difference in run costs between the two chambers. Much debate on this question; the issue is not completely resolved yet….

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5) Thermophysical properties of sapphire (Jordan)

Nothing new to report. Per Peter's request, Jordan will make available results of vendor measurements.

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6) Wrap up, upcoming deadlines (Gary)

- Sapphire order (large blanks) needed soon.
- Core optics design requirements (technically one month late).
- Optic modeling summit at MIT in one month; David pointed out the efficacy (necessity) of firing up the FFT codes to look at scattering from sapphire from dominant **k** modulations.
- Jim noted that there is as yet no Q testing planned for Heraeus SV glass. As this is a baseline for the AdL beamsplitter, we might want to get on it.

There was no afternoon telecon.