1986
Boulder Damage Symposium
Closing Remarks

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It certainly appears that the Symposium is alive and prospering. We had about 190 participants this year. Besides the presentations we have heard and seen, the most important ingredients of this event are you the participants. I was most glad to see the considerable interaction that took place during the course of the meeting. This year, perhaps more than any other year, there were more requests for papers and discussions going on in the hall. I hope this is not an indication of the one major problem we still have and that is that people want to get the information now rather than wait for the proceedings to come out. In that regard, I would like to show you what we do to people when they don't get their manuscripts in by publication time. We, in fact, do publish the paper and we put up on the top of the manuscript, "manuscript not received", title, author, abstract and discussion, all inside this very wide very black border. We are prepared to do it again this year. We have all the papers for 1984 and as I said we got promises from everybody who was here concerning the delinquent papers for 1985. They say they will all be with us before this calendar year is out and we are essentially almost finished with our reviews so we hope to have that to the publishers early in the next calendar year.

There are some observations that I would like to make about this particular year's meeting. Most of you who do know the history of the conference realize that it started out as a mini-symposium of the laser section of the American Society of Testing and Materials. The ASTM is a standards setting organization. We were going to have this meeting for a year and maybe two at the most, and by then we would have solved all the problems; we would have standards, and off we would go and we would know all about laser induced damage. That was eighteen years ago and it was interesting for me to note that somebody got up here on the stage today and said he sent the same samples to two places for testing, two of the premiere testing places, and one came back with 0 joules per square centimeter and the other came back with 30-40 joules per square centimeter. I think that observation says that we still have a way to go, but that way to go may be the fact that we still have not agreed on definitions, test protocols, how we can record our particular data, data analysis procedures and other aspects of this subject, or, for that matter, even what damage is. The lesson we can take from the standards community is that it is, in fact, generally done by consensus; by people in the field. In the ASTM there are people who are not only vendors or buyers but people from within the Government, particularly the National Bureau of Standards, who are, I wouldn't say exactly innocent bystanders, but are supposed to be objective participants to interact with this group to, in fact, help in standardizing test protocols so that, in fact, the tests and the procedures are material sensitive and not test or operator

sensitive. I hope, as a result of some work that we started a few years ago on Round Robins, that this may trumpet, at least to our community, a need to carry this on and continue this work to develop a standard damage procedure or a reporting mechanism so that we can enhance the communication in this field of obvious importance.

Another item heard at this meeting was somewhat of a renaissance in the discussion of chemical polishing. For years we heard the discussion, "get the dirt out, get the dirt off the surfaces" and we heard something about laser annealing. There is no question that what we are hearing today, however, is not only just the application of those techniques to make improvements in the cleanliness of surfaces and samples, but by doing it in such a manner that you don't destroy the optical quality such as the topography of those samples, that we are, in fact, strengthening the surfaces. When it comes to thin films, there was a lot of discussion of thermal conductivity and I suspect there will be a lot more in the future. There was a question asked today about "Is it thermal conductivity or diffusivity that you are interested in?", and the answer came back that "You really are interested in the product of the density and the specific heat and the thermal conductivity." I agree with those comments but I would like to point out that the density cannot vary very much including packing fraction considerations, which for most film materials that we are talking about, are like 10-20%, unless you are dealing with something like sol-gels, or what have you. The specific heat is something that is really a composition-dependant property of the material while the thermal conductivity, which seems to be varying all over the map is structure-dependent. This is the property over which we have the most control and opportunities, I may add, for improvement.

Last year I gave a talk back east and I made the comment that at this meeting I heard someone talk about thermal conductivities of a specific material and one person said that it was a factor of 5 lower than the bulk, yet another paper reported a factor of 50 or 60 below and someone just recently had said it may be as much as 600. I make the observation that I did not know which one was right. Well, someone in the audience pointed out that they may all be right and that, in fact, is true because the thermal conductivity structure dependent is, therefore, very process-dependent. I think as we proceed further with these thermal modeling calculations, in an attempt to understand the failure mechanisms, I think we are going to have to go more into what we have been alluding to all these years, and that is a correlation of process with structure. That is why I personally feel that techniques like spectroscopic ellipsometry may be a useful, nondestructive test that will allow us to find something out about the film structure simply and inexpensively. It still also means that we have to take the same films and have the thermal conductivities measured by a variety of techniques or the diffusivity so that we can, in fact, have some confidence in the numbers that are being presented.

Those are just some comments that I have for this meeting. We would like to thank all for your participation. We would further like to thank the National Bureau of Standards again for acting as our host. As you know, we have selected a date for next year; October 26-28, 1987. As of now, those are the dates. There is a possibility that those dates may change by one or two days, but we are pretty sure it is going to be that week. That will be the week before Halloween and that will be in preparation for our big 20th in 1988. We will start to think about what we'll do and if anybody has some suggestions or ideas, I am sure all of the conference co-chairmen, Hal Bennett, Dave Milam, Brian Newnam and myself would be most receptive of your inputs and if there is any way we can improve this meeting, please let us know because we are flexible. Last, but not least, we would like to acknowledge the following most important individuals whose support before, during, and after this Symposium have helped make it the success that is was: Ms. Susie Rivera, Ms. Patricia Whited, Ms. Edit Haakinson, Ms. Sharon Chesnut and Ms. Ann Mannos.

Thanks again for coming. Have a safe trip home! See you next year.