



**Alfred University Glass Strength Conference
20 August 2009**

Attendance (some during only a portion of the day)

Richard Blanchard – Diageo; John Brown – GMIC; Steven Brown – Emhart; Carol Click – O-I; Alastair Cormack – Alfred; Dave Gibson – Brampton Nameplate Inc.; Suresh Gulati – Corning; Chuck Kurkjian – Consultant; Bill LaCourse – Alfred University; Lou Mattos – Coca Cola; Nathan Mellott – Alfred; Charles Merivale – Amalgamet; Viral Modi – Saint Gobain Containers; Carlo Pantano – Penn State; David Pye – Alfred (retired); Sean Sabet – Saint Gobain Containers; George Sakoske – Ferro; Emilio Spinosa – O-I; Yang Su – Emhart; Arun Varshneya – Alfred

Gabe Tincher – Facilitator
Michael Greenman - GMIC

Interests of Participants

- Nathan** – surface properties as related to glass strength, enhancing strength with regards to processing and coatings.
- Steven** – Interested in making glass the foremost packaging material- lightweighting, stronger bottle – sell more machines. See it grow – regain market share over plastic. Strength is an important factor for the consumer (safety) – fearful, weight? somewhat.
- Carlo** – Technical aspects of strength – roles surface plays in strength – fatigue, things we can do to glass surfaces when manufactured. (Treating hot glass after flaws are in it, or before). Narrow look at coatings ‘til now. No coatings looked at specifically for strength.
- Chuck** – 24/7 activity for me. Understanding mechanical damage is my primary concern.
- Suresh** – Strengthening approaches that are economical, pragmatic and results oriented. “moving the tail to the right”. Improving surface damage resistance and retaining strength over long term.
- Spin** – Like to see increase in intrinsic strength of glass so can do in furnace if possible as opposed to adding process step. Move tail to the right. Not enough to increase strength. The public has impression that glass will break on them.
- George** – Technical/Practical – issues of strength over years. As coating manufacturer, see as an important functionality of glass.
- John** – Economic Terms – U.S. has had a good run last 60 years: economy, lifestyles. Questioning whether we can maintain jobs. Best means to establish is to change usefulness of glass. Opportunity for many more applications. Economic force – worldwide. No segment will uniquely benefit by strength – all will benefit.

-**Alastair** – From fundamental, theoretical level – understanding structure, property relationships. Interest in understanding how changing composition relates to improved strength. Also looking at molecular, atomic scale structure – how contributes to mechanism of strength. How water, other environmental agents interact with surface.

-**Michael** – Glass is seen as brittle – operating at far below potential. Potential is enormous. Can impact society – “Age of Glass” – as get closer to theoretical performance.

-**John** – Vancouver – Bulent said that it’s hard to take the idea that a brainless creature like an Abalone can make a shell that is 3000 times stronger than anything we can do.

Structure of Effort – Working Group (Chuck)

Research Leadership Team – containing subgroups of disciplines, each having its own group. Start with core research group – Segments could be:

- Theoretical Strength – Dick Brow
 - Fatigue – Shelly Wiederhorn
 - Composition – Fred Wallenberger (retired PPG)??
- Damage – Chuck Kurkjian
 - Jim Varner, Minoru Tomozawa
 - Composition?
 - Processing
- Coatings – Carlo Pantano
 - George Sakoske
- Theory and Modeling – Prabhat Gupta
 - Alastair Cormack, Li Ping Huang (RPI)
- Theory, Practice, and Applied – Suresh Gulati
- Strengthening – Bill LaCourse
 - Arun Varshnaya, David Green
 - Composition?

Research Leadership Team (Glass Strength)
(Name Changed to “**Core Research Team**” – CRT)
Chuck Kurkjian (over all coordinator)

	<u>Principal Investigator</u>	<u>Area of expertise</u>	<u>Associated researchers</u>
I	Dick Brow	Strength/fatigue	Sheldon Weiderhorn
II	Chuck Kurkjian	Damage	Jim Varner; Tomozawa
III	Carlo Pantano	Coatings	GeorgeSakoske; Bulent Yoldas
IV	Prabhat Gupta	Modeling/Theory	Li Ping Huang (RPI), Alastair Cormac

V	Suresh Gulati	Theory & Practice
VII	Arun Varshneya	Strengthening (Ion exchange) Bill Lacourse, David Green Thermal Tempering Laminating high inside an low expansion skin. Combinations of the three

Budget to assemble the “Road Map”

15 people, 5 nights for \$250/ day for food and lodging plus \$1,000 for travel= \$35,000

Principle writer and organizer, Carlo Pantano expenses for two months = \$15,000
\$50,000

(Each group can work independently, draw into their group any others)

How do we get funding? Half are involved in writing papers for David Pye’s Journal. This could form a document that could be used for funding.

Launch a broad based robust glass strength research program with the following attributes:

1. Collaborative Funding
2. Clear, well-defined goals
3. Cross product/cross segment expectations – impact defined
4. Short term, medium term, long term deliverables
5. High probability of success in increasing as-used glass strength 3-5 times.

Where will be appeal to get funding and how will that process work?

Comments

-To develop – annual budget for 15 people, \$100,000 each = \$15mm

Judge of results has to be companies has to be companies, government, funders

-Both theoretical and experimental in scope

Funding

- I. **Proposal – Plan** - what might this cost?
 - a. Get Proposal funding (Seed \$) **Sept. 2009**
 - b. Meetings to come up with proposal/white paper/roadmap (probably cost \$50K minimum) – 80 hours of chargeable time. (by end of **January 2010**)
 - i. \$15k for leader
 - ii. \$35k contributor expenses
 - c. Will identify phases of research and areas of focus.
 - d. This will give a good idea of what research will cost

- e. Need team leader – someone needs to be hired. A company can commit someone, or we have to hire someone to pull proposal together. Graduate Student?
 - i. Each core research team show how their work will contribute to the whole.
 - ii. Chuck Kurkjian?
- f. Function of time to ensure don't lose momentum –
- II. Selling it, getting it funded? – hire an agency? itecs? Other?
 - a. Save jobs, big picture, Warren Wolf, Fred Quan, others
 - b. Workshop in DC with government officials – help from DOE? (**May 2010**)
 - c. Get glass companies involved in visits to DC.
 - d. Funding secured by (**September 2010**) – launch program.
- III. Research Program
 - a. \$1.5mm per year for 3 years.

Very little research funding in glass – “no big picture” therefore need big thinking.

Carlo – NEG sending grad student to US to work on edge strength; looking for someone to go to Japan. IMI sponsoring Chuck to go to NEG in Japan.

Strength Liaison Team

(Name Changed to: Strength Steering Team – SST)

Demonstrate broad industry interest, assist in lining up the \$\$, selling the value, making the business case

- I. Users
- II. Suppliers
 - a. Equipment Manufacturers
 - i. Emhart
 - ii. Dave Gibson (Brampton Nameplate Inc.)
- III. Producers
 - a. Container - Spin
 - b. Fiber – Bruno
 - c. Flat – Zeledyne,
- IV. GMIC
 - a. Executive Director
 - b. Technical Director
- V. Universities – Leadership
 - a. Deans
 - b. Provost

Gap between Theory and Implementation

USERS

Need to have ongoing user input

Dave Gibson – “Strength per-se means nothing” – Real need is reducing weight of current production,

- lighter glass curtain wall, lighter container, lower “E” footprint.
- Safety, legal, liability, (exploding glass)
- Cut weight of bottle in half
- Cut in energy use/cost in making, transporting bottles. Compete with hydrocarbon based plastic containers.
- Architecture – need “P” engineering to substitute lower weight glass in commercial/industrial bldgs.
- Transportation – but re-engineering issue involved. High costs. Glass in rail cars – reducing weight permits additional technology to be introduced.

Factors

- Economic value of change must pay for the re-engineering.
- Secondary packaging for boxing glass not needed for plastic or cans.
- Must remain 100% recyclable.
- Design of bottle a factor – do something with shoulder and heels. Strengthen bottles through design.
- Esthetic – get better designs (look more delicate, but stronger)
- Lower environmental impact – energy, transport cost reduction.
- Meet sustainability goals – can’t meet with current processes.

High to low LCA

- Returnable/refillable glass
- Returnable PET (thicker walls)
- Non-returnable PET
- Non-refillable glass
- Aluminum (high charge at front end)

Polymer industry – petroleum – huge lobbying effort – glass loses. Needs to counter this. Haven’t been fighting back.

“There is no perfect package – there is a perfect package for every application”.

Channel these opportunities in containers – bottles with increased strength less weight.

- Glass holds cold/heat longer
- Biodegradable –friction erodes
- Inert – non-polluting.
- No industry group is lobbying for glass as is the case in plastics.
- Buy glass cheaper

➤ Show sustainability progress – “we are green” – need to show a reduction in costs.

O-I – ready to support with funding GMIC to provide fundamental research as a coalition. Once we get into application R&D, problems arise.

Increase in strength/lighter wt. has real in use value – therefore do basic/fundamental research.

Must overcome limit of \$s to do this as individual entities therefore must collaborate.

David – Can it be done? Yes

Is it worthwhile? – Manufacturers, users, government need to be on board. **Critical factor for success.**

Issue of proprietary interests – need to have a coalition with agreements going in. Have to get corporate support

Three factors are new:

National Nanotechnology Initiative

America Competes Act

Cap and Trade

Dave Gibson – APTA – American Passenger Transportation Agency – goal to extract money out of Congress – have committees to do these things too. Transit agencies are non-competitive with each other. We are – if we can get beyond that. Need association of glass producers and users.

John - Enhance glass by polymer coatings on outside?

Examples of processes

1. Sub-merged combustion melter – in-kind and \$50M
2. Glass batch – RFP – too vague

For PSU 9/14&15.

Prior - Chuck outline work of 6 Glass Strength committees – one page document

Michael and John pull together **Steering Team** and obtaining commitment for seed money for Core Research Team.

On 14-15 September

-Research Team – meets to develop the research direction.

-Steering Team – Meet to discuss further – overall plan – involve “stakeholders” (mfrs. and users).

Corning, O-I, O-C, JM –

Identify funding agencies

Get paperwork – (itecs and examples of funding requests from agencies)

Plan attack plan for DC meeting. How get interest in government.

What are goals of research?

How to bring research team's ideas to the glass companies.

How get buy in from all the potentially interested funders/supporters.

Agreement in place regarding collaboration on pre-competitive research. How to manage matching funds.

How do we deal with proprietary information brought into the process.

Monday evening – get together – working dinner

Tuesday 10:00 – 12:00 - combined wrap-up.

Standalone – March 3 We. – meeting in Columbus – Workshop. Planned by Steering Committee at Penn State.

-Presentations from Glass companies - “This is the kind of thing that we do”.

Forum of papers – 4-6

What have we missed, done

-Nathan – focus on core research team getting details down on roadmap

-Steven – getting a feel for what GMIC is trying to accomplish

-Charles – not sure about government's appetite to fund this sort of issue.

-Richard – Go to other glass companies not members to engage; time line seems long. #1 on list

-Carlo – fact that more companies involved is successful. Move forward

-Carol – Has potential – encouraged. I'm biggest skeptic. Clearly defined groups picked to move forward.

-Andy Walsh- Libbey - Strength, durability – in top five strategic things for our company. Known technology is impractical and anti-green. (400 KW of electricity to get that strength)

-Leo – Concern that committee wants to get funding for research and don't know what research we want to do. Need overriding goal. Not fully convinced where we're going. If industry moves towards stronger glass we can use it. Pieces of research funneled down to produce objectives.

-Alastair – moving to details from big picture. We're in risk of mixing big picture and detail.

-Suresh – “Strength and reliability are us”

-David – encouraged with what I've seen. Concerned that Bill's meeting was “fund me”. This meeting is “fund me”. Encouraged by cohesiveness, getting recognition of need for everybody that we need to do something. Need for focus is very clear. Research is good, but another tier on political side, and consumer side – is important. Three prong approach.

John – Thrilled with the day. We've gone further than I expected to go. So important to have users involved. Thrilled to have Coca Cola here to get their viewpoint.

Arun – 1983 Emhart VP – said to me: how do you see that we could form a group on glass research that would pass through Dept. on Justice. Said: real competitors are competitive materials. Glass research on strength was not so good. Didn't make much progress. Have gotten better understanding

on strength of glass. Hopeful that industry groups will come together again and re-nucleate what we were trying to do.

Chuck – Always been discouraged by involvement of glass members. Pleased by core group, and hopeful that you will stir up manufacturers.

Spin – Very productive – have plan forward, have industry committee in place to guide effort and show interest to funding agencies. Long schedule, but have to live within fiscal year.

George – If we could make “Gorilla Glass” bottles today – what’s that worth for sustainability?

Getting bottom line contributions to society should be part of our roadmap: stronger lighter windshields? Sometimes feel the glass industry needs a new “float process” – but industry doesn’t have in it to design new process, doesn’t want to come together to fund it. May need to get group together to design a new way to polish.

Suresh – mission accomplished