Waste = Resource
Waste to Landfill = Buried Treasure....

Rev: June 2010

inc engineered materials

1. Waste is a resource.
2. When we put it into landfill, we are burying the treasure.
3. Today, I will introduce you to a new and exciting technology.
4. I hope that today is one of those days for you
5. Today I will introduce you to a technology that we believe will create valuable business opportunities, and provide a valuable to break for our poorly stressed planet.
6. In fact, I hope that this presentation will excite you, as I am excited, about this new opportunity to go in search of buried treasure.
7. It is not often that you can “I was there”….but today you are.
8. So – let’s set sail.

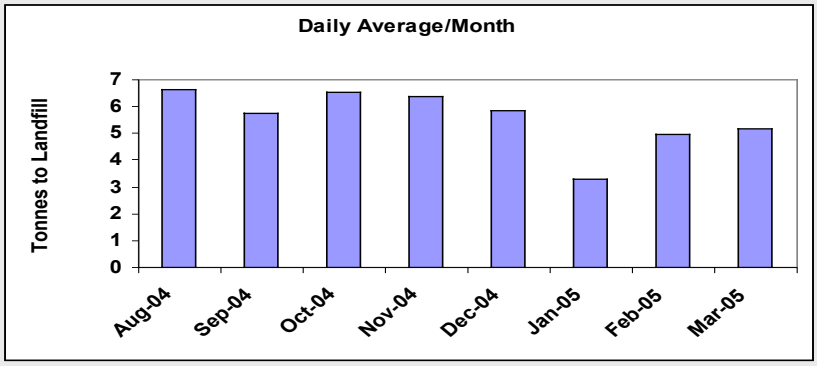
This is a Resource

1. Let's talk about resources for a minute.
2. We all know about the Global Financial Crisis.
3. Did you know that Australia was one of the few G20 countries in the world that did NOT go into recession.
4. Of course, our Government takes credit for spending literally billions of $ on financial stimulus.
5. Naturally, the reality is different.
6. The truth is that Australia is blessed with massive natural resources that we simply dig up and send to China.

But.....is This a Resource?

1. Resources drive economies.
2. But sometimes we can be sitting on a resource, and not even realise it is there.
3. This truck is loaded with textile waste that is being dumped into landfill.
4. So we have to ask the question
5. Is this a truck load of waste - or a truck load of resource?
6. Every company producing any form of textile waste is sitting on an untapped resource.
7. If you have any doubts, perhaps the numbers will be persuasive?

At the Beginning – waste survey



At (say) $1.50/kg, waste value > $1.8 million pa

1. So – allow me to take you back to the beginning of our 5-year journey at I.N.C. engineered materials.
2. In 2005, we were producing large numbers of package trays (rear window trims), trunk trim, and insulation from bumper to bumper.
3. Now, remember that we are talking about a small company in Australia – a manufacturing market representing less than 1% of the total world production of motor vehicles.
4. Inspired by a massive 412,000 grant from our state government, we conducted a waste survey.
5. We measured our waste to landfill.
6. We measured the mass inflow of raw materials.
7. We assigned a mass to every component that we sold.
8. Then we assigned a raw material value to the waste.
9. Then we had a brainwave….
10. Our small company, at the other side of the earth, was wasting a resource worth nearly $2 million per annum.

A Global Problem

- A quick calculation
  - 65 million vehicles pa.
  - Say 20kg of textiles per vehicle
  - Say 30% overall waste
  - 390,000,000kg of textile waste pa
  - At (say) €1.50/kg
- TOTAL RESOURCE VALUE = €585 million pa

1. We highlighted a problem and discovered a hidden resource.
2. We had found a new business opportunity.
3. Returning 2005, and remembering that Australia produces less than 1% of the world automobiles.
4. Also, we were not producing carpets, headliners, or seating,
5. And we had about 50% market share.
6. My guess says that we should multiply OUR waste by a factor of 4 just for the Australian market.
7. Applying this to the world market we get something like EU600 million.
8. But, do the numbers stack up?
9. So let's do a very simple calculation and I suspect that it will be open to criticism.
10. If the world produces 65 million autos each year, and 20kg of textiles are used, with 30% wastage
11. And we assign a value of EU1.50/kg, then we have a resource worth EU585 million pa.
12. That sounds familiar and even if we reduce it and say EU 400 million – it is still a big resource, and a lot of money.

The Value Equation

- €585 million pa of raw material resource
- Complete material utilisation
- No need to grow any more crops
- No need to replace any food production
- No need to take any extra oil out of the ground
- No need to add to landfill

- Simply utilising production waste!

1. Now, of course, we are all very conscious of the need to improve our environmental performance.
2. There is a big trend to the use of renewable resources –
   a. Natural fibres
   b. Synthetic fibres made from sugars and proteins.
3. "Natural fibres" come at the cost of food production
4. And, with thousands dying daily from starvation (we won't go into the political reasons for that), can this be justified?
5. It also comes at some cost to the environment through the use of pesticides and fertilisers – derived in many cases from petroleum products, and themselves a diminishing resource, and causes of their own environmental problems.
6. So, if we can treat the waste as a resource, and utilise 100% of our raw materials, then we are really doing the planet, and the people, a huge favour.

The Value Equation

- The tip of the iceberg
- The total global resource is very much greater than this.

- In the USA alone, over 2 billion kg of PCC carpet to landfill annually @ €1.50/kg = €3 billion pa

1. But the resource is much bigger than this….
2. The automotive industry is just the tip of the iceberg.
3. If, like the iceberg, there is another 90% under the water, we have a resource that could be worth EU4-5 billion as a raw material.
4. If you think this sounds ridiculous. Consider this….
5. Every year in the USA alone, 2 billion kg of post consumer carpet is dumped into landfill.
6. At my EU1.50/kg, this is worth EU3 billion pa ON IT"S OWN.
7. I think my sums are conservative.

A massive resource waiting for a technology … and a market

Buried Treasure!

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1. So, I hope that I have convinced you that there is a massive issue here.
2. If we view the broader possibilities, pretty soon you're talking serious money!
3. Here is a resource that is waiting to be mined, and all it needs is the right tools.
4. Perhaps you already knew, but didn't know what to do about it?
5. Well, we call this resource buried treasure – but it doesn't have to be buried.
6. Does anyone feel guilty about this?
7. Well if you don't now, you will when we go a bit further…..

Conventional Textile Recycling

- Sorting

- Rag Tearing

- Rotary Cutting

- Pulling

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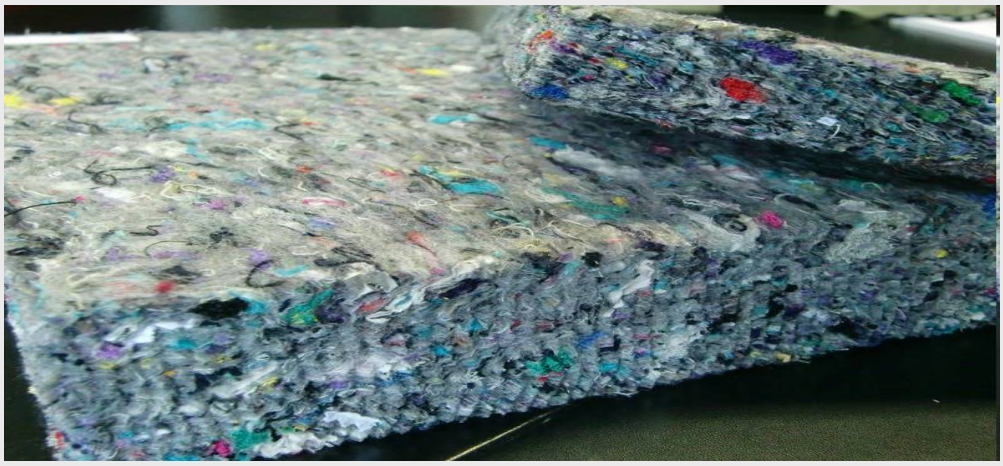
1. I guess I should stop for a second here and address the question that many of you will be thinking.
2. We already recycle textile waste.
3. There are processes already that do this.
4. Well the answer is – yes, and no.

5. Conventional textile recycling uses equipment that seems to have some sort of passing resemblance to medieval torture chambers – cutting, pulling, and tearing equipment

Conventional Recycled Textile Waste



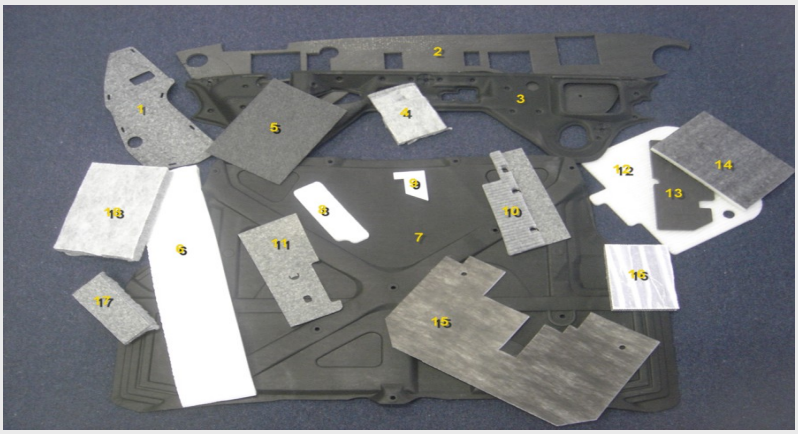
1. Conventional textile recycling liberates fibres
2. It frees them up to be used again – as fibres and short lengths of yarn.
3. “Shoddy” has been a staple of automotive insulation for decades.
4. And, there are other products that bury great chunks of waste into a similar structure to the shoddy.
5. Yes, this is recycling,
6. But, no, the processes and the products have serious limitations.

The Conventional Problem

- Largely unsuitable for bonded and processed textile waste, ie most automotive waste textiles
  - Up to 40% of material is wasted – matrix and trimmings
  - Waste is mixed
  - Most cannot be processed through traditional textile processes
  - Waste is not readily separated

1. Conventional processes do not cater well for textiles that are
2. Coated
3. Laminated.
4. Moulded
5. In other words, most of the automotive trim produced, including
6. carpets,
7. trunk trim,
8. headliners etc
9. And, conventional processes don’t work for mixed waste.

Typical Fibres & Polymers



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1. If we take a selection of insulation components we make at I.N.C.
2. We find that we have a variety of different polymers
   - LDPE
   - LLDPE
   - HDPE
   - PP
   - PET
   - Other
3. We also find that these are laminated, coated, moulded and cut.
4. So, not only do we have a whole mixed up bunch of different materials, but….

Designed to Waste Resources

1. The auto industry is expert at designing in waste that the vehicle manufacturer never sees.
2. The design of auto components builds waste into the parts.
3. In this example, this lightweight dash insulator (an I.N.C. patented technology) is made 100mm bigger in all dimensions, to allow gripping for moulding
4. Then there are cutouts
5. Ant the shape is far from regular,
6. So there is an enormous amount of waste built into this part – amounting to around 15-20%

Designed to Waste Resources

1. And it gets worse
2. Simple flat cut insulators are never rectangular.
3. Depending how the parts are cut, waste can be greater than 50% - if you don't believe me, wait and see…

Designed to Waste Resources

1. And this dash outer insulator (again I.N.C. patented technology) has so many holes you wonder how it could be useful at all.
2. Waste approaches 50% with this part.

Designed to Waste Resources

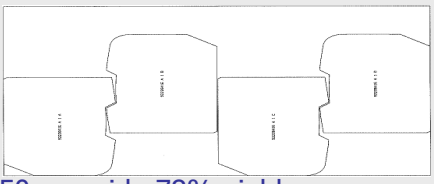
1. So we end up with bins full of waste
2. In this example, the waste is another insulation for which we have a patent application pending
3. This consists of combination of PET fibre and LLDPE film laminated to both sides of the fibre. It performs brilliantly as a sound absorber, but the waste cannot be recycled by conventional means.

Designed to Waste Resources

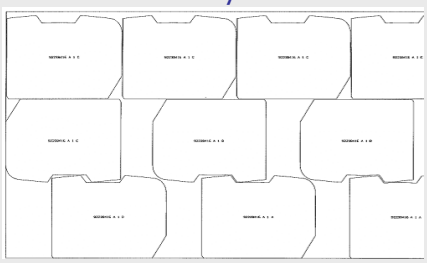
1. And finally, this matrix comes from moulding trunk trim
2. It is a combination of PP with an SBR latex backing.
3. Not recyclable by conventional means

Cutting Layout Resource Waste

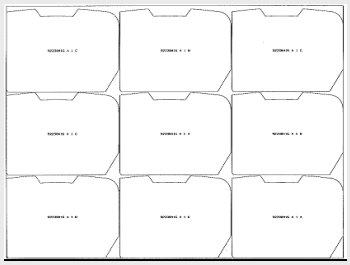
- 1200mm wide 57% yield



- 1950mm wide 78% yield



- 2000mm wide 91% yield

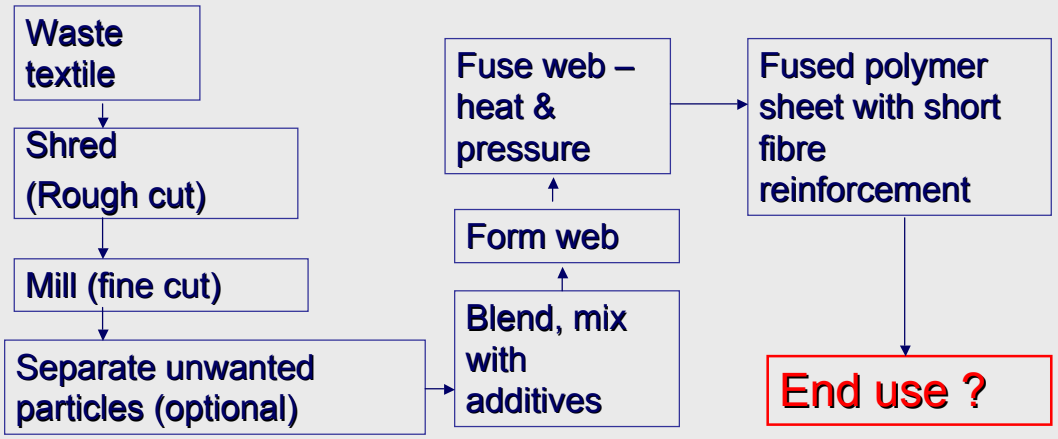


1. And for wastage on flat cut parts, try this out…
2. These illustrations show cutting layouts for CAD/CAM knife cutting of a simple shape, but on different widths of insulation.
3. Yield can be as low as 57%, or as high as 91% if the raw material comes in the right width
4. Is this considered when the shape is designed?.

5. Is anybody feeling guilty yet????

1. The new waste strategy at I.N.C. engineered materials says..
2. No waste to landfill
3. No waste separation
4. Reuse and recycle within the premises using the same materials
5. Achieve 100% yield out of all textile purchases
6. Source waste from within the same industry to ensure the material waste stream is at least known
7. Selectively recycle and reuse materials from other industries – especially if there is a consistent supply
8. And it calls for a process that makes all of this waste compatible.

US Patent Application # 12/169495



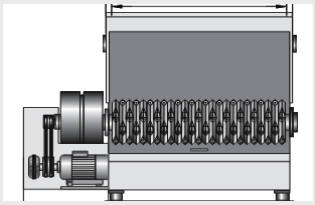
1. We needed a technology that would allow us to take advantage of the resource we had found.
2. We needed the tools.
3. In conjunction with Monash University, Professor Alfred Eiden, and others, we applied plastics recycling technology to textiles.
4. This flow chart describes the techniques applied
5. Please note that last box – “end use” because having a technology is useless with out a product and a market.

Suitable Materials

- Textiles incorporating thermoplastic content
  - Woven
  - Knitted
  - Nonwoven
  - Bonded
  - Coated, eg PU, PVC
  - Moulded
- Process
  - Mill to fine particle sizes and short fibres, 3-10mm
  - Create a homogeneous mixture of short fibre recyclate
  - Fuse the whole into a homogeneous form – sheets, moulded parts

1. Almost any textile is suitable for our process.
2. We don't have to separate waste.
3. We can use everything we produce in house and we can achieve zero waste to landfill.
4. So
5. We take the waste
6. We apply size reduction techniques
7. We produce a Short Fibre Recyclate
8. We then produce a web of SFR
9. And we make a SF nonwoven product suitable for a variety of aplications.

Stage 1 Shredding

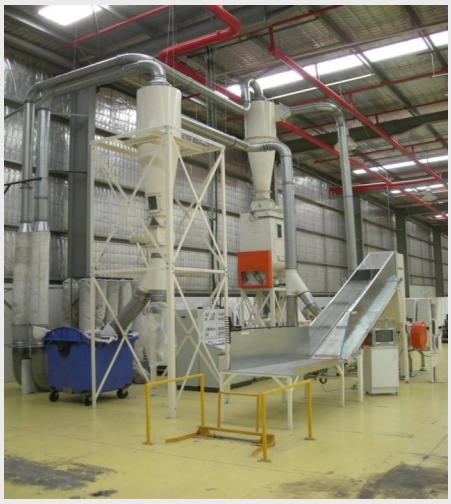


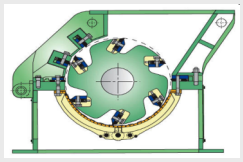
1. Preliminary size reduction achoeved through a shredding process.
2. We can literally tip rolls of carpet into this machine and start the process

Shredder Output

1. Here is the output from the shredder
2. A mess of bits and ieces of mixed textile waste.

Stage 2 & 3 Knife Milling



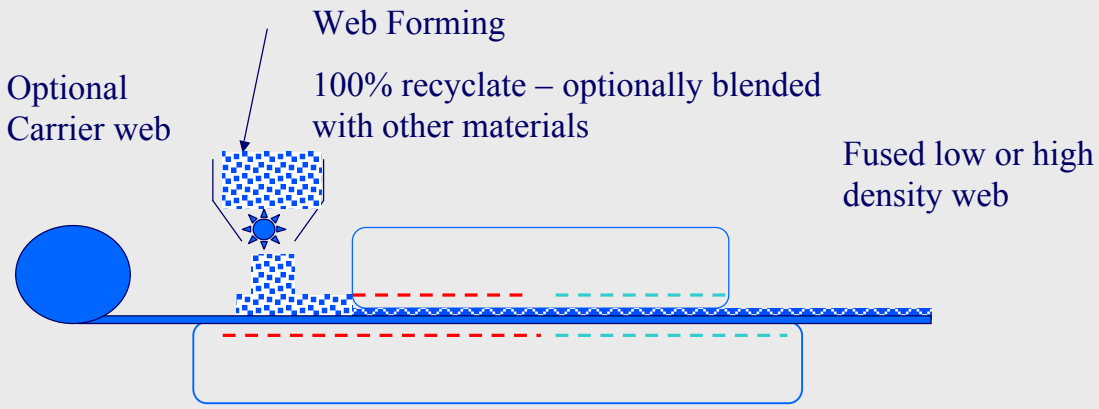


1. The next stage is knife milling
2. This is done in two steps, to produce particles of the right size for the end use.

Stage 4 Web Forming

1. Then we form a web
2. This device has been developed especially for this process as there was no known system that would create a uniform homogeneous web from SFR

Schematic Web Formation



1. The final stage is to fuse the web through a twin belt compression unit, creating a high density mixed textile sheet.
2. It is also possible to reduce the density and we have also developed an air bonding process for this purpose.

100% PET Insulation

- Contents
  - PET insulation with low melt binder
  - No additional binder

1. So let's look at some examples
2. I have pieces of these with me if anyone is interested to look at them during the break.

PE Film Faced PET Insulation with Low Melt Binder

Contents

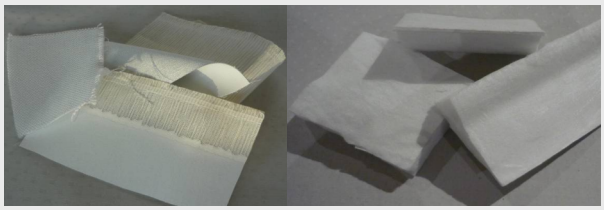
- PET insulation with low melt binder
- Laminated PE film facing
- No additional binder

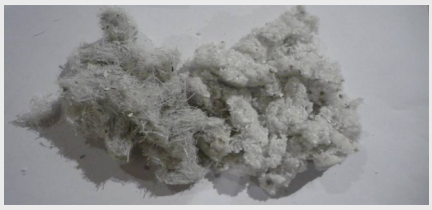
PET Dash Outer Insulator

Contents

- Dual density moulded engine insulator with high temperature low melt binder
- No additional binder

Coated Blind Fabric + Moulded Auto Insulator





Contents

- Woven acrylic coated PET blackout blind fabric
- PET insulation with low melt binder
- No additional binder

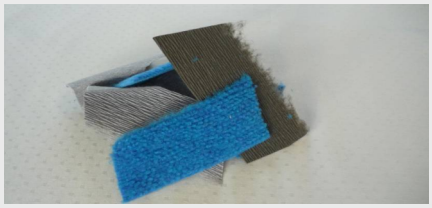
Foam Backed Auto Upholstery Laminate

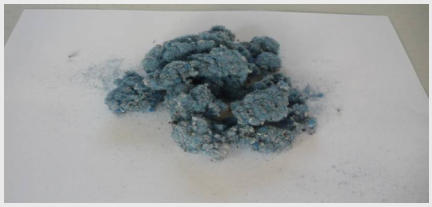
Nylon Commercial Carpet

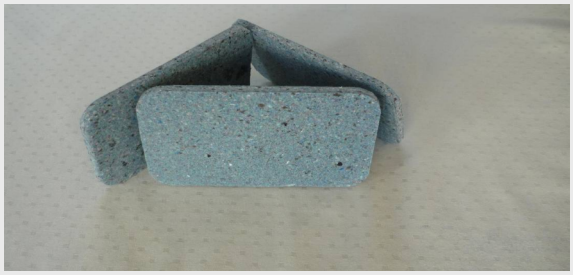
Contents

- Nylon fibre
- PP primary backing
- Hessian secondary backing
- Latex backcoating
- Added – PET low melt binder

Nylon Commercial Wall Fabric



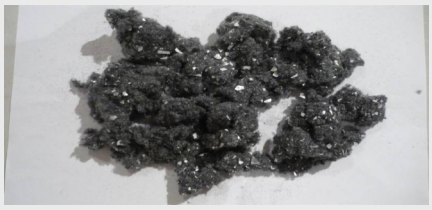


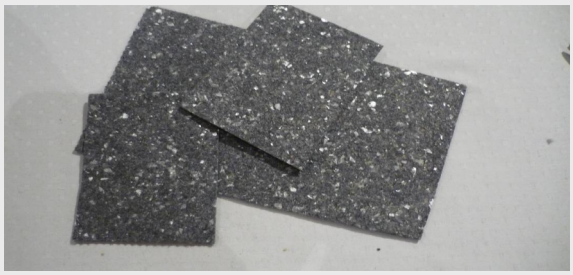


Contents

- Nylon wall fabric
- Low melt nylon binder
- No additional binder

Adhesive Backed Foil Faced PET Insulation





Contents

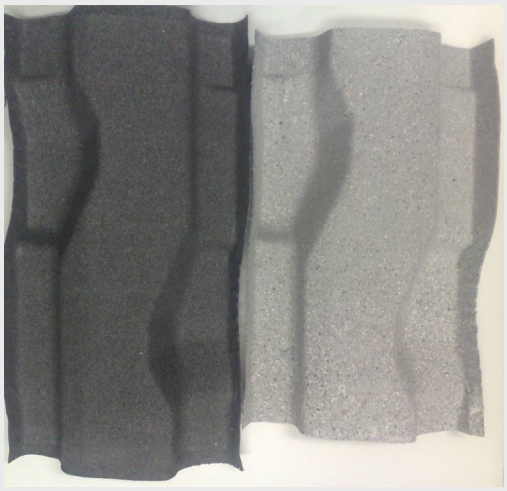
- PET insulation with low melt binder
- Laminated aluminium foil facing
- PSA backing with silicone release liner
- No additional binder

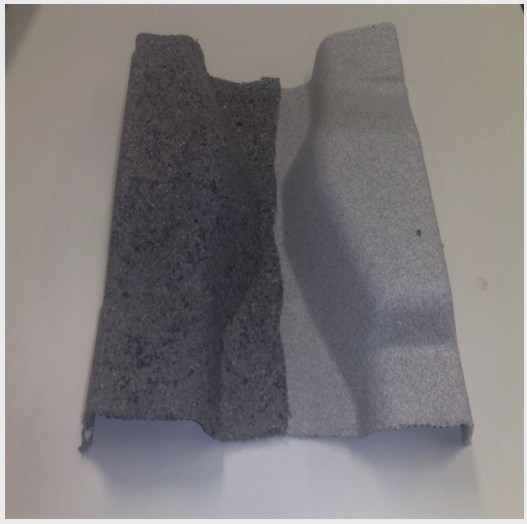
Wool Upholstery Fabric

Contents

- Woollen upholstery fabric
- PET laminated backing
- Added – PET low melt binder

Moulded SFR Components





Benefits of SFR Technology

- Free raw materials
- High processing rates
- Homogeneous blend
- "Fluid" behaviour when heated
- Maintains wall thickness in draw areas
- Maintains acoustic properties in draw areas
- High compaction ratio allows high stiffness components

Acoustic Benefits of SFR Technology

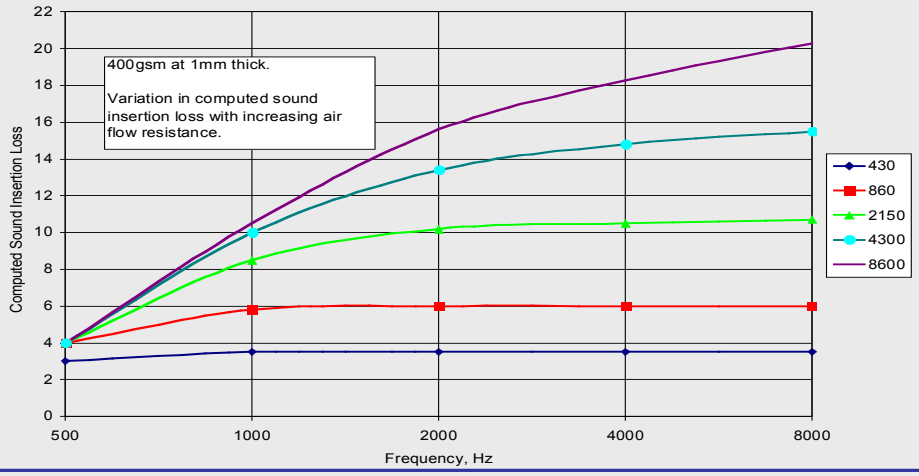
- Higher performance lightweight insulation through higher air flow resistivity than any staple fibre constructions.
- Lower binder levels required
- Resulting in lightweight insulators with significantly greater sound transmission loss.
- Dramatic boost in low frequency sound absorption
- Minimal real-life trade off in sound absorption at higher frequencies.

- A better balance between sound insulation and sound absorption at lighter weights than ever achievable in the past with staple fibres – USING WASTE!!!!

1. As we specialise in acoustic materials at I.N.C., we were keenly interested to see what we could achieve acoustically from this approach.
2. Some of you will be familiar with lightweight insulators that can replace heavy mass barriers in many applications.
3. I.N.C. actually has several patents relating to high flow resistivity materials for use in this field
4. But short fibre nonwovens blitz all of the existing technology.
5. We get much more sound transmission loss, ie the materials behave much more like heavy mass barriers,
6. But the sound absorption, which is absent with mass barriers, is still excellent – especially at troublesome low frequencies.
7. Providing the best of both worlds for lightweight automotive insulation.
8. All done using waste!

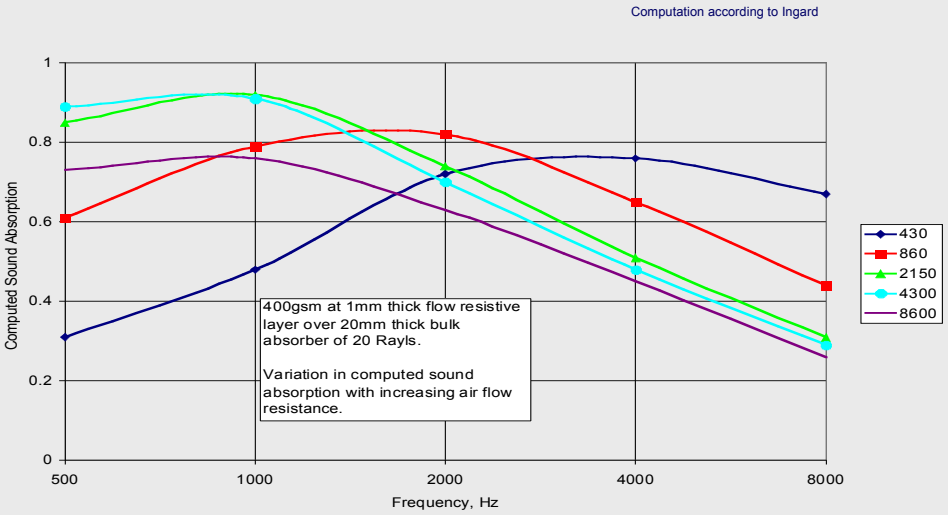
Sound Transmission Loss

Computed according to Bies and Hansen



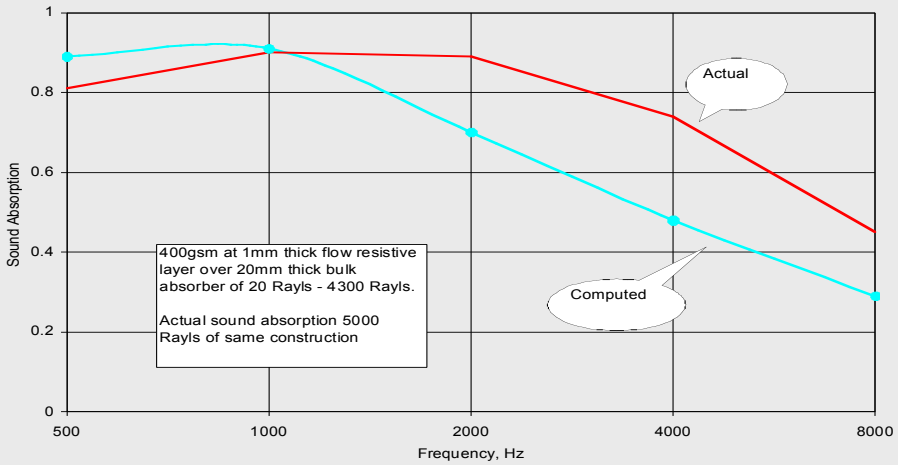
1. This shows how ytransmission loss for porous materials depends on flow resistivity and the massive gains achieved by highly flow resistive materials
2. Results not achievable with staple fibres.

Computed Sound Absorption



And, although theory says that we will lose a lot of high frequency sound absotpion

Real-life Sound Absorption



1. Actual testing shws that we don't.
2. SF nonwovens have many more uses than as incredible acoustical insulation
3. We are working with a number of customer s and will have products commercial later this year in markets such as
4. Architectural finishes
5. Acoustical wall linings
6. Underlay for flooring systems
7. And much more…..
8. All I ask of you is to use your imagination – where can we use this technology, and let's not keep burying our treasure.

Thank you for your time!

1. So – has everybody become a pirate in search of buried treasure?
2. As with many new ideas, I fear that I may have opened up Pandora's box, but
3. There is a massive business opportunity for those willing to take the risk
4. I.N.C. has spent almost AUD4 million developing this technology so far.
5. Now we need customer s and partners who share our passion.
6. I have my samples here if you would like to see them during the break.
7. Thank you for your time and I will be pleased to answer questions.