



**the designing of
biodegradable products;**
experiences and challenges

Jac. Gofers

BiPP by The Netherlands

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- ↪ biodegradability: the consumers perception
- ↪ biodegradable, compostable or sustainable?
- ↪ functional use of material properties
- ↪ consumer in a world of regulations; the challenges



bpp[®] biodegradability: the consumers perception

- consumers are not interested in the production-methods or degradation methods of their products



bpp[®] biodegradability: the consumers perception

- consumers are not interested in the production-methods or degradation methods of their products
- claiming biodegradability is no ground for a price raise



bpp[®] biodegradability: the consumers perception

- consumers are not interested in the production-methods or degradation methods of their products
- claiming biodegradability is no ground for a price raise
- biodegradability is (still) no sales driver



biodegradable, compostable or sustainable?

➤ why bring bdp's to the market?



biodegradable, compostable or sustainable?

- why bring bdp's to the market?
 - decrease (landfill) waste



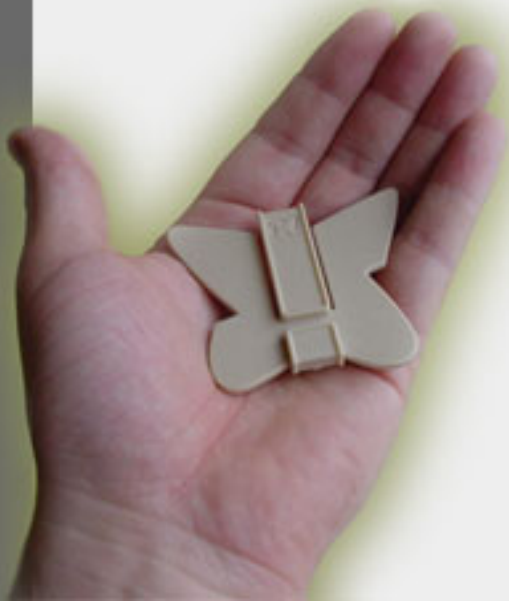
biodegradable, compostable or sustainable?

- why bring bdp's to the market?
 - decrease (landfill) waste
 - save fossils fuels/energy



biodegradable, compostable or sustainable?

- why bring bdp's to the market?
 - decrease (landfill) waste
 - save fossils fuels/energy
 - become more independent of fossil fuels



biodegradable, compostable or sustainable?

➤ why bring bdp's to the market?

➤ decrease (landfill) waste

➤ save fossils fuels/energy

➤ become more independent of fossil fuels

➤ reduction of GHG-emissions



biodegradable, compostable or sustainable?

➤ why bring bdp's to the market?

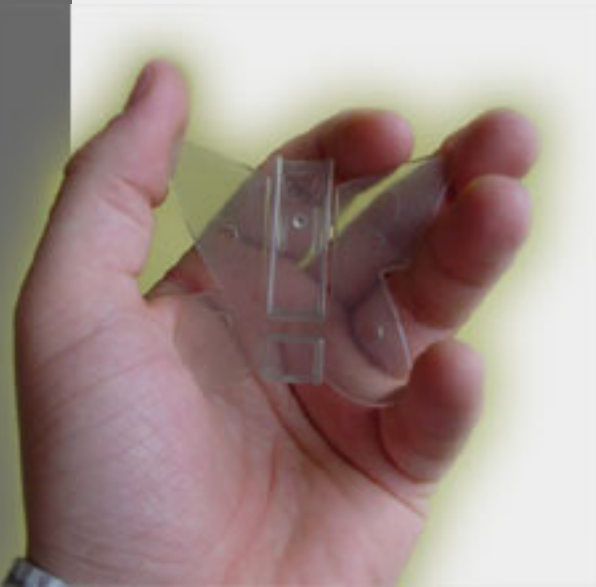
- decrease (landfill) waste
- save fossils fuels/energy
- become more independent of fossil fuels
- reduction of GHG-emissions
- specific material properties



functional use of material properties experiences

↪ plastics besides wood, metal, paper and glass and ceramics

↪ hard to substitute <-> easy to substitute



bpp^{♻️} examples



bpp[®] examples



bpp^{♻️} examples



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bxpp examples



b⁺pp^{♻️} examples



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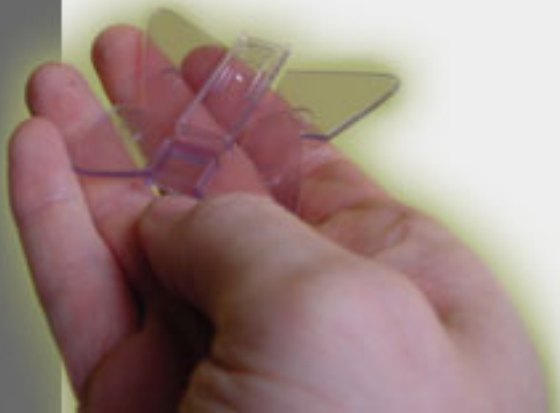
bpp[®] examples



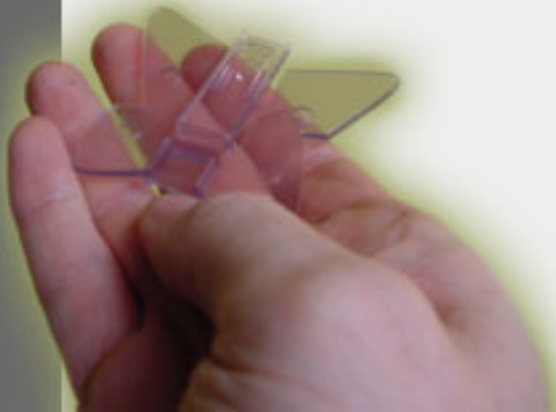
b⁺pp^{♻️} examples



- ↪ functional aspects other than biodegradable: as usual



- ↪ functional aspects other than biodegradable: as usual
- ↪ biodegradable aspects:
 - ↪ be temporarily durable



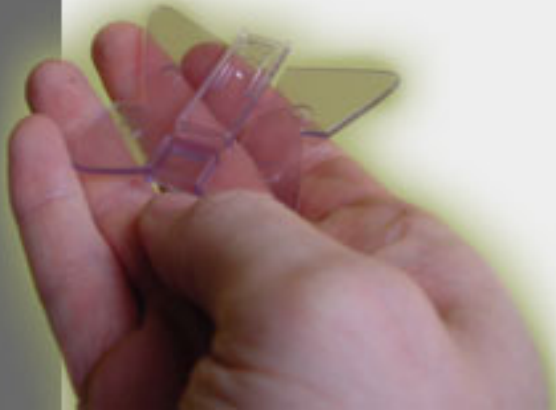
- functional aspects other than biodegradable: as usual
- biodegradable aspects:
 - be temporarily durable
 - eliminate handling



- functional aspects other than biodegradable: as usual
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- functional aspects other than biodegradable: as usual
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 - be temporarily durable
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 - biodegradability as function

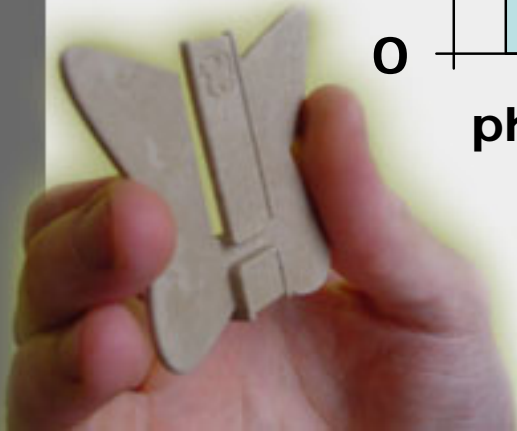
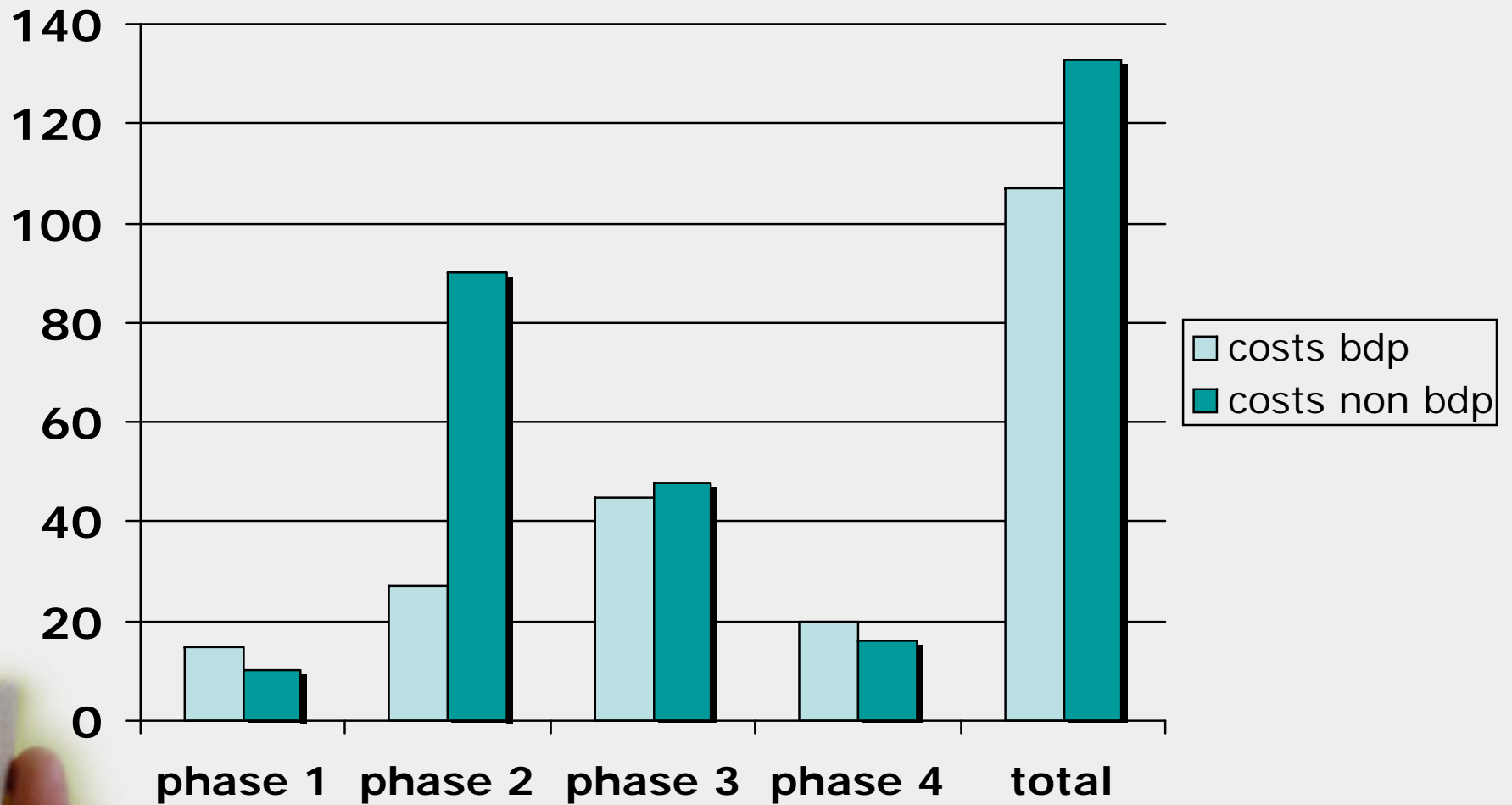


consumer in a world of regulations

- ➔ LCA's for cost-shifting governments:
legislation



total/partial benefit



consumer in a world of regulations

- LCA's for cost-shifting governments:
legislation
- Energy saving and waste-management:
legislation



the success of bioplastics on the market

- Add functional material value to the product to design
- Run LCA's for governmental use
- Solve waste-problem by good and uniform legislation



the success of bioplastics on the market

➤ Add functional material value to the product to design

➤ Run LCA's for governmental use

➤ Solve waste-problem by good and uniform legislation

➤ continue development and improvement of material properties and price levels





the designing of
biodegradable products;
the end
experiences and challenges

Jac. Gofers

BiPP bv The Netherlands

www.bipp.nl

The designing of biodegradable products; experiences and challenges

Introduction

A couple of years ago, one of our customers heard about *fully biodegradable materials* that could be applied for injection moulding and thermal forming. As we are an innovative company with no fear for any experiment, he came to me and asked whether we could design the packaging for his product in this 'new' material. 'Of course' I said, 'but why would you do so?' 'It's good for our green image', he answered. 'Will it bring you more business, or does it prevent your existing business from decreasing?' I asked. 'It will bring us absolutely more business' he said, 'people are aware of their environment-responsibility, so they'll buy rather my product than my competitor's'. 'O.K.', I said, 'let's answer some questions. First: Your product will be more expensive because of higher feedstock-prices and somewhat longer production times. Will that be no problem for your competition-position? Second: how can your customer distinguish between your packaging and that of your competitor's and is he willing to do so? Third: what's in it for the customer?'

I'll save you the rest of our discussion; he finally decided not to take the risk of loosing his complete business because of 'his green image'! Wishful thinking instead of 'functional' thinking brought him to the idea; rational thinking lead him to his decision.

Actually, this behaviour of this manufacturer is comparable to that of the customer; everyone is basically interested in contributing to a better environment, but if it is not based on an average economically mechanism, the only way to reach this goal is to prescribe it by legislation. And when this legislation is lacking, the customer is finding his way through alternatives and choices and will (in majority) choose for the known and cheapest alternative.

With this in mind, the following topics are reviewed in this paper:

Biodegradability: the consumers perception

Biodegradable, compostable or sustainable?

Functional use of material properties; experiences

Consumer in a world of regulations; the challenge

Biodegradability: the customers perception

What is biodegradability? Away from the technical definition it has something to do with the way a material is vanishing after the product which is made out of this material is dumped; it's the way a product is 'de-created' after it had its 'life'.

But the average consumer *is not interested* in the way how the product is manufactured (created) neither in the way how the product is degraded (de-created) after he dumped it, as long as it doesn't hurt him or (more and more) his (future) environment.

The average consumer however is willing to contribute to a better environment if this does not need a too much active attitude which will distinguish him from his neighbour and if it does not cost him (much) money.

This means that the behaviour of the consumer is different of that what he is telling in all kinds of polls. There it seems (different from country to country) that he is very much prepared to pay (somewhat) more money for all kinds of products that (makes him) contribute to a better environment. Off course he is! In these polls, no-one will take 'the risk' to get known as someone who isn't caring for the environment and giving an answer to those questions is not anonymous: a person in real is facing you!

Back in the shops or supermarkets however, one can easily compare different brands of the same desired product and choose (anonymously!) for the cheapest instead of for the most environment-friendly product.



So, if in this case the reason for the higher price for the product is just the higher costs of the packaging material and this does not add any other value for the consumer than *biodegradability*, it will not be a very successful introduced bio-packaging.

In fact, in general It can be said that only governmental regulations or legislation, which thus counts for all competing products of a certain branch, can bring higher costs to a product without adding additional value without changing market positions of the different competitors. In practical all other cases, individual price raising for the consumer (and accepted by him) should be caused by a newly added (and perceived !) value of the product.

Back to biodegradability.

For most consumers biodegradability as such is something that's still vague and only of interest to them by force of ongoing society-developments while lots of questions are not yet answered:

For instance:

Is there enough infrastructure to take away the biodegradable material in a separate waste flow once the product is dumped?

Can he recognise (or will he remember) that the product is biodegradable once he is dumping it?

What does he 'feel' (in terms of money) from the fact that he is acting 'green' when buying biodegradable products?

Is biodegradable compostable and compostable biodegradable?

And if he is (finally) buying biodegradable products, will the product not biodegrade before it is dumped?

So it seems that for the moment, claiming biodegradability will have very little effect on the increase of sales as long as this goes along with an increase in sales price.

By the way, did you ever buy your cotton shirt or wool suit because it is biodegradable?

So it was right not to claim this on these products although they are very biodegradable!

Biodegradable, compostable or sustainable?

One of the basic questions we ought to ask ourselves is why we want to introduce biodegradable polymers (bdp's) to the market?

Some valid and often heard reasons are:

The need to decrease our (landfill-)waste;

The need to save fossil fuels/energy for other applications;

The need to become more independent of fossil fuels;

Reduction of GHG-emissions;

The specific material properties of a biopolymer;

To my opinion 4 of those 5 reasons, which are not exhausting, need to be handled on a governmental level.

The doubtless need to decrease waste-flows and GHG-emissions and to save on fossil fuels are not influenced by a simple individual consumer, nor by a single company. In these above mentioned reasons it is necessary that legislation (at least



per country but favourable global) sets conditions that do not interfere with competitors levels as such; every company or consumer-market has to deal with and fulfil the same regulations!

If this is not ruled by legislation, the substitution of materials to biopolymers will remain very difficult and depending on further developments in material properties and price levels to the extent that they are 1-to-1 comparable.

In this way, there has been made a serious effort by issuing the EU-composting directive, EU-landfill directive and EU packaging directive.

On the other hand, the only standard that is accepted at the moment by the EU-commission is the standard EN 13432 for organic recovery (Composting) (In comparison: USA ASTM D6400, Japan GreenPla). All other EU draft-standards to this topic (EN 13428, EN 13429, EN 13430, and EN 13431) were rejected. Other speakers will deepen this out.

But this composting standard is in practical only valid for waste-packaging because of the demand that after 180 days, 90% of the waste should be disintegrated.

This means that biodegradable not per sé also means compostable. A bunch of synthetic polymers are biodegradable, but not compostable to these definitions of compostability. Also, these do not contribute to sustainability because they still are made out of the fossil fuels so not renewable.

Even a lot of bio plastics made out of renewable recourses or rather products made out hereof aren't compostable according to our standards although they are biodegradable and contribute to sustainability. In fact, according to these standards, a rather thick branch of a tree *is not compostable!*

I understand the need for this standard and why it has been set up as it is done. On the other hand, there are a lot more products on the market than just packaging. How shall we deal with these when dumped even when they are made out of biodegradable materials and even when they are dumped through a controlled infra-structure? Shall it be waste-bin or bio-bin?

Still, these materials are very useful in reaching the goals of reducing waste flows because it seems to be an illusion that we ever will reach the point that every consumer all over the world will gather his waste and bring it to the infra-structure controlled bio-bin or waste-bin. There will always be people who throw away products or packaging just out in the field. And if those products are made out of non-standard-compostable though biodegradable materials, the final state will be H₂O and CO₂, although it may take a long time.

But then again, shouldn't we bother more about the yes-or-no harmful impact on the environment instead of yes-or-no compostable?

At the end of this chapter just a few words about sustainability.

To my opinion sustainability should be the only driver in developing new materials and designing new products! In all cases, be it packaging or artefacts, sustainability will bring the desired function to the consumer with the right level of use of resources.

And off course, promoting bio plastics is in a certain way contributing to sustainability, especially where it concerns renewable resources. But it's only part of it. Sustainable thinking goes beyond this.

Functional use of material properties: experiences

As said before, consumers are not really interested in the way things are manufactured.

Most people do not have a clue when you ask them how (e.g.) their hot water boiler is made or their day-to-day ball-point or shirt button. They just accept that those are here, that they can use them and are unaware of the production-methods and logistics that brought these to them.



And this is a logical evolution: Handcrafting has gone and the modern ways of production are complex and people have jobs with names that do not ring bells anymore. What is someone doing when he is process-operator? Or computer-programmer? Or accountant? How should I explain those activities to my 3,5-years old daughter? Even the baker (this still does ring a bell!) isn't the baker anymore. He hardly touches the flour with his hands.

And in this evolution we developed products. Artefacts.

And we developed and applied materials and processes. And developed new products.

And researched and experimented. And developed new materials and processes. And applied those. And developed new products. Even developed *markets*.

And very often we came to the application of a certain material because it gave us a functional or economical benefit. And we were able to develop new products, products that didn't exist before *just because of the lack of the specific material!*

I'd like to show you some examples of application of material properties:

(examples of application of typical properties of materials; hard to substitute)

(examples of good substitutions of materials)

(examples of bad substitutions of materials)

And then there are *biodegradable materials!*

(examples of specific application properties of materials; hard to substitute)

(examples of good substitutions)

(examples of bad substitutions)

In fact, as you can see, we can set-up a comparable range of products when just taking the focus on biodegradability. Also if we had taken 'hardness' or 'transparency' as comparing aspect, we would have been able to create a list of product-examples.

In other words, biodegradability is a material property that is interesting to talk about with scientists, designers, manufacturers and politicians, but not with the average consumer.

To my opinion when promoting bio plastics we should communicate our products to the consumer in terms as:

cheap

easy to handle

light weighted

modern

comfortable

providing status

durable

friendly to the environment

no removal tax

sustainable

biodegradable (!)

.....



- depending on the specific demand he has of the product we want him to buy.
- From a functional perspective we could consider applying bio plastics for a whole lot of products that are now being manufactured out of synthetic plastics, with as only added value that when the product is dumped, this can be done ecological, environmental harmless!
- Because of economical reasons this doesn't make sense at this moment in time, (imagine you need to pay more for a biodegradable laptop in a society where competitors fight for 'lowest prices!) and it might even make no sense ever.
- So asking ourselves in which products we could apply bio plastics from the biodegradability point of view in a rational way, we could formulate the following product aspects:
- They should:
 - be temporarily durable (packaging in general, (medical) disposables)
 - eliminate handling (bulb-screw®, paper-pot, waspaway®)
 - be safety serving
 - have biodegradability as function; controlled release of additives (fertilisers, colours, fragrances)

➤ The consumer in a world of regulations: the challenge

- In the discussion of how to convince people to apply and buy biodegradable products, often is heard that we should look at the complete cycle from 'cradle to grave'. To my opinion this is correct only to a certain extend. The 'Cradle to grave' life cycle analysis show us at what stage of the cycle, which costs are made. But as not every so called 'phase-owner' is able to shift costs from one phase to an other, the benefit in one phase may lead to disadvantage in the other. This means that although an overall benefit is reachable, the specific 'phase-owner' may take a negative decision, which in that case breaks the whole cycle!
- Lca's should therefore be used by the governments to create legislation in order to take the benefits of one phase to compensate for the disadvantages of another. The final result is an overall benefit *and* a benefit for every individual 'phase-owner'.
- Furthermore, our society is globalising as well for consumers as for manufactureres. It seems not to make sense to create heavy demands on products for one country if those demands are not effective in another.
- Energy savings and environmental benefits that are offered by bdp's are topics that have to be handled on a political level in a total waste management policy, preferably global.
- And, as a matter of fact, the problem of waste management has never been so simple solvable as it is today with the availability of biodegradable materials!
- So, in conclusion I should say that the success of bio plastics on the market is near if we cope with the following challenges:
 - To add functional material value to the product to design
 - To run LCA's for governmental use
 - To solve the waste problem by good and uniform legislation (politics)
 - To continue development and improvement of material properties and price levels

