

Transformation to Fibre Cement from Asbestos cement

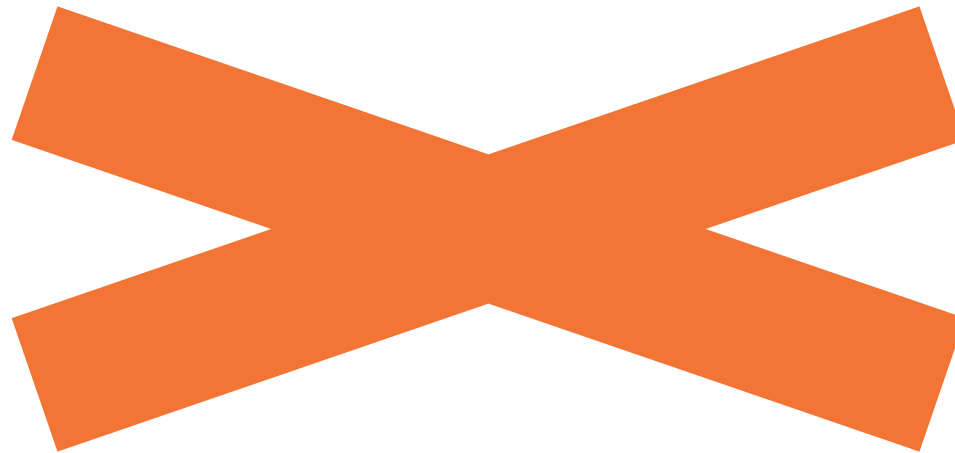
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Asbestos

- Asbestos is a group of nature fibres with excellent mechanical properties.
- For decades it has been known that asbestos constituted a major health hazard, and it was given up by the producers.

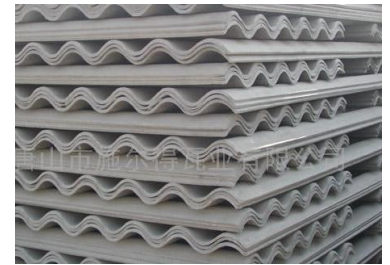
	Asbestos group	CAS No:
1	Chrysotile	12001-29-5



Traditional asbestos cement

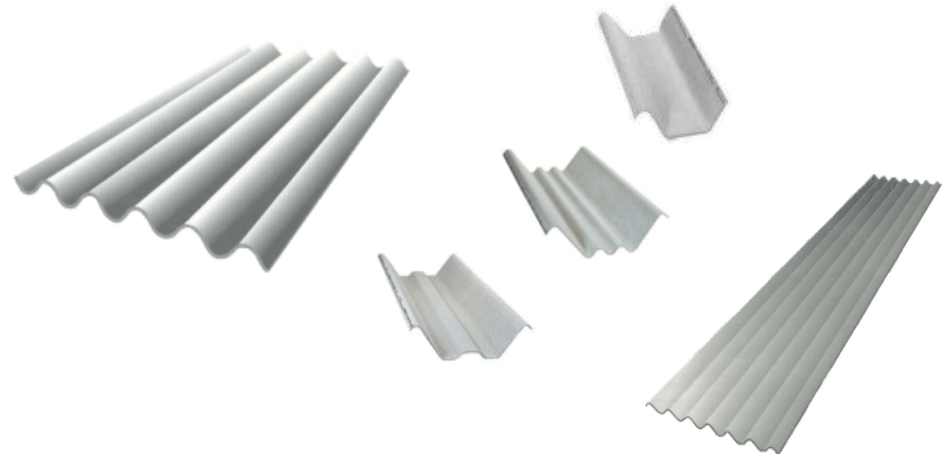
Traditional asbestos cement

- Asbestos (10 – 15%)
- Portland cement (85 – 90%)
- Fillers (fly ash, slag...)
- Water



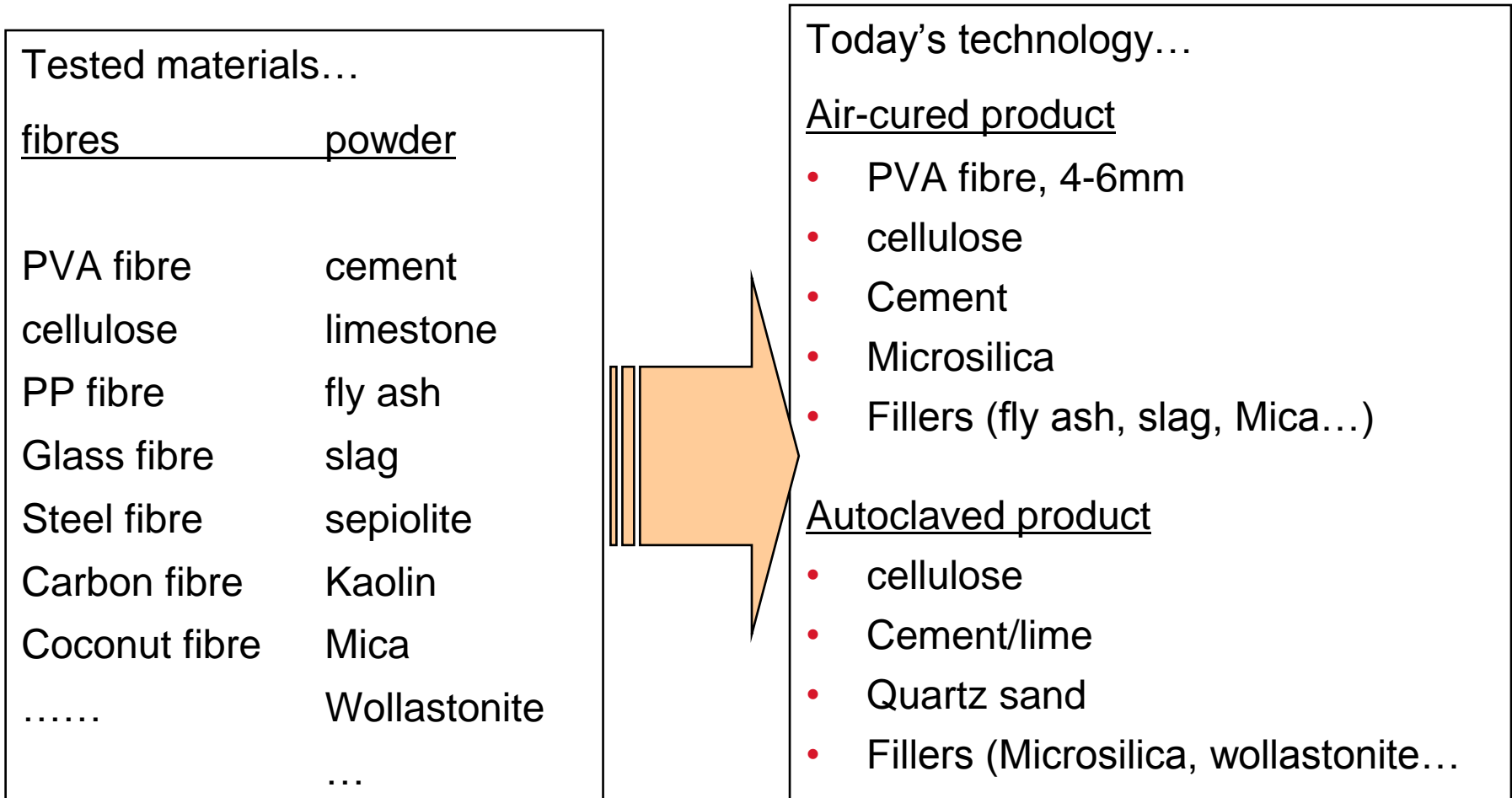
Products

- Corrugated sheets (roofing)
- Flat sheets (side boards etc)



Transformations to Non-asbestos

There is no single fibre known that directly can substitute asbestos; new composites have been developed with practically same properties.



Raw materials of fibre cement product

- Main powder: Cement, lime, quartz sand
- Fibres: cellulose, PVA fibre, PP fibre, Glass fibre and etc.
- Additives: Microsilica, Wollastonite, limestone, Mica and etc.

Main powder



Cement



Lime



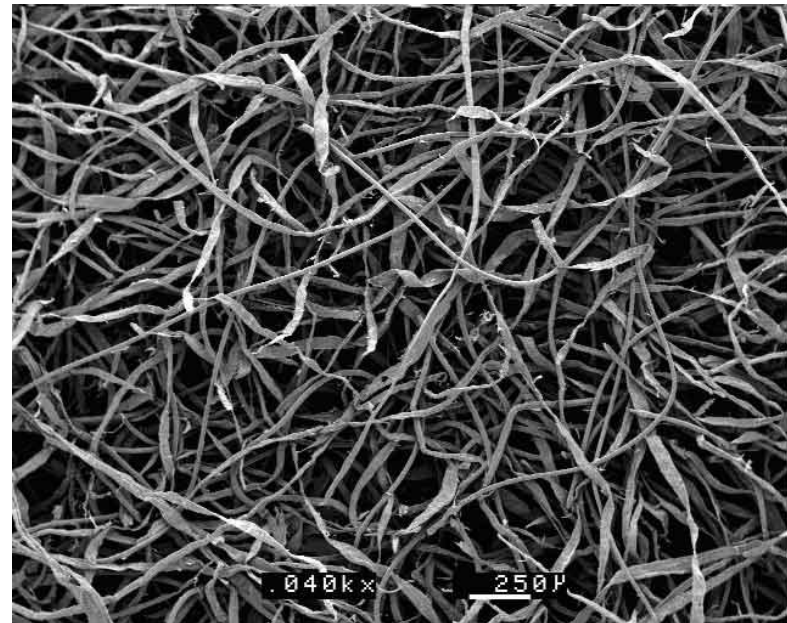
Quartz

Fibres: Cellulose and PVA fibre

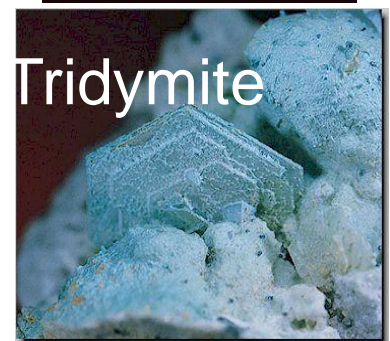
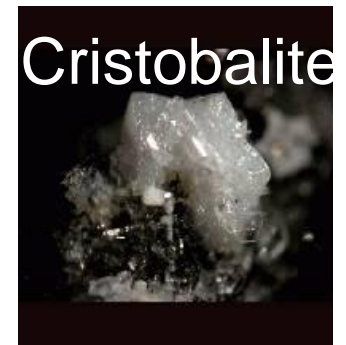
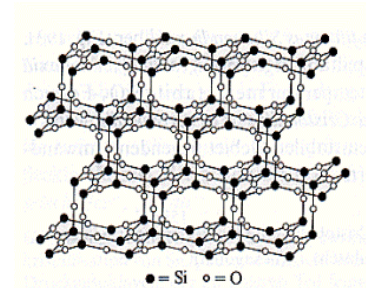
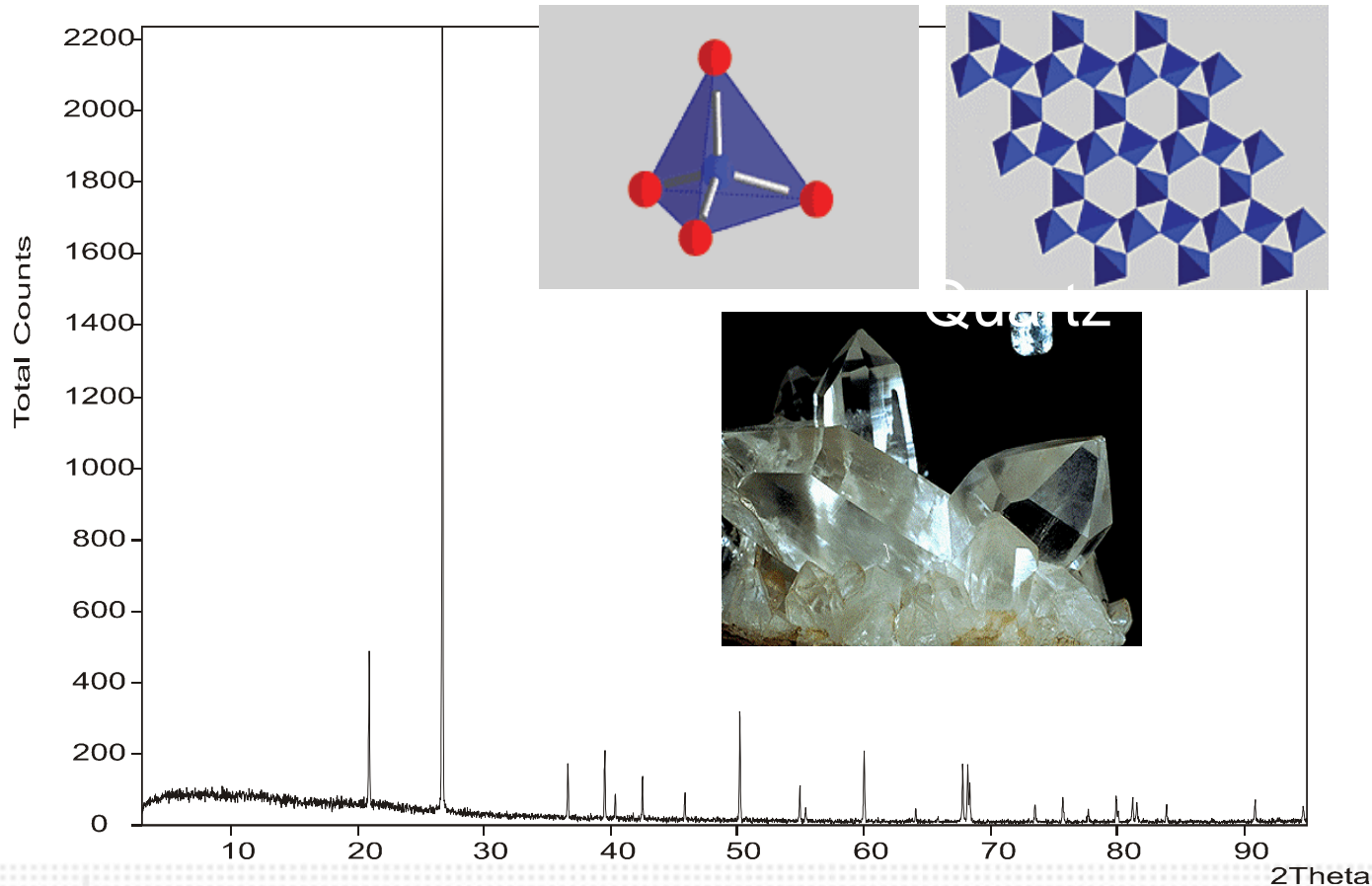
PVA - fibres



Cellulose fibres

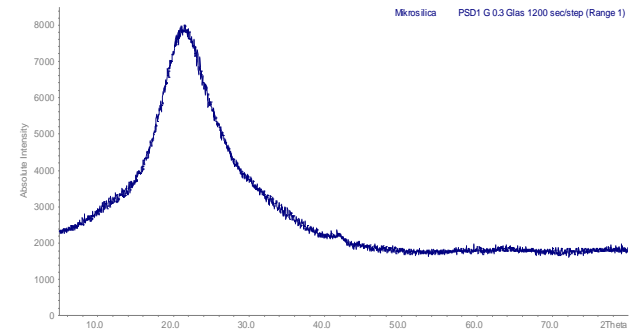


Siliceous materials: quartz sand.

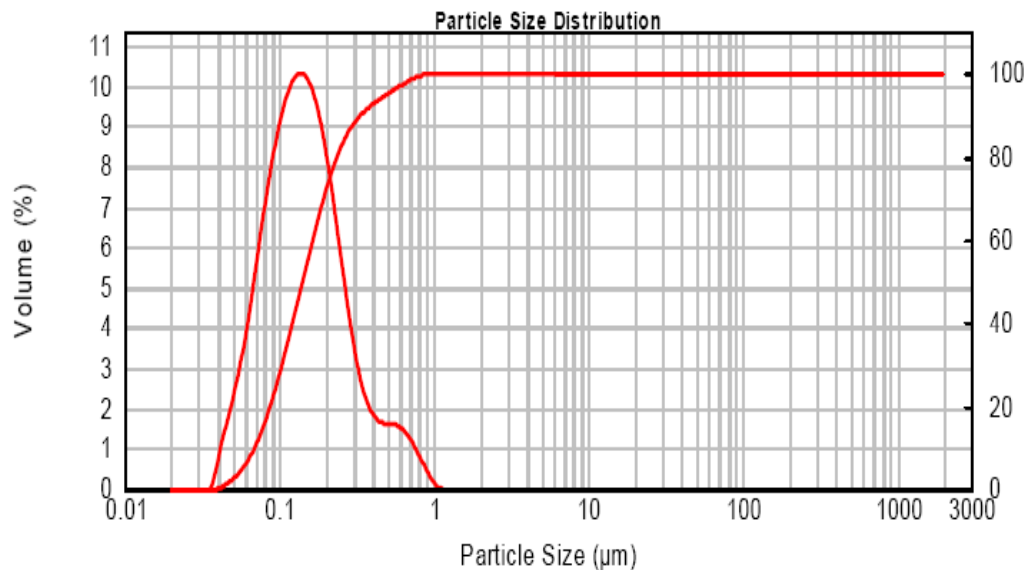


Additives: eg. Microsilica®

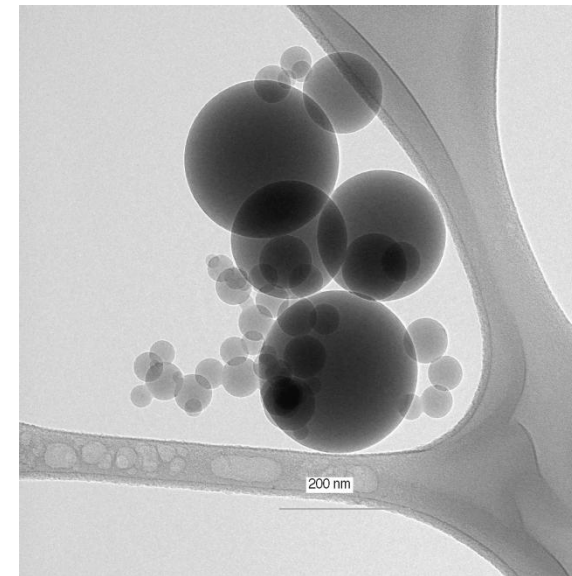
- Ultrafine, **amorphous** silica powder
- Spherical particle shape
- Primary particle size: 50-700 nm; av. 150 nm
- Off-white to dark grey colour



• XRD pattern



• Typical PSD chart



• TEM picture

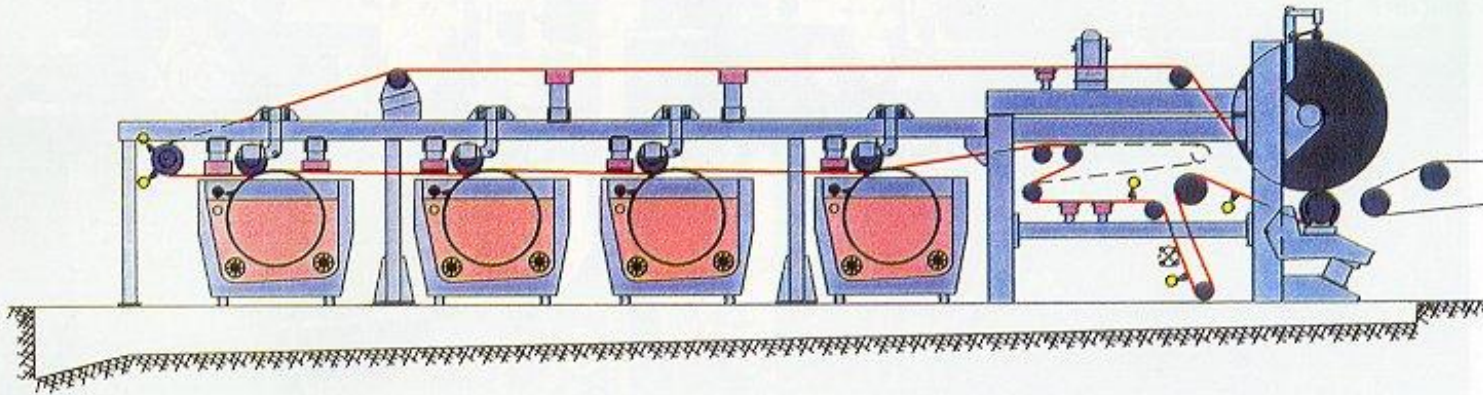
Classification of non-asbestos fibre cement product.

- Based on the curing technology
 - A. Air-cured fibre cement product
 - B. Autoclaved fibre cement product
- Based on the process
 - A. Hatschek process
 - B. Flow-on process
 - C. Extruding process
 - D. Spray process (mainly for GRC product)
- Fibre cement product shape
 - Corrugated sheet
 - flat sheet
 - pipe
 - others

Hatschek process

Fibre Cement Plants - Sheet Machine

FC-SHEETMACHINE



Fibre cement production



Cellulose treatment

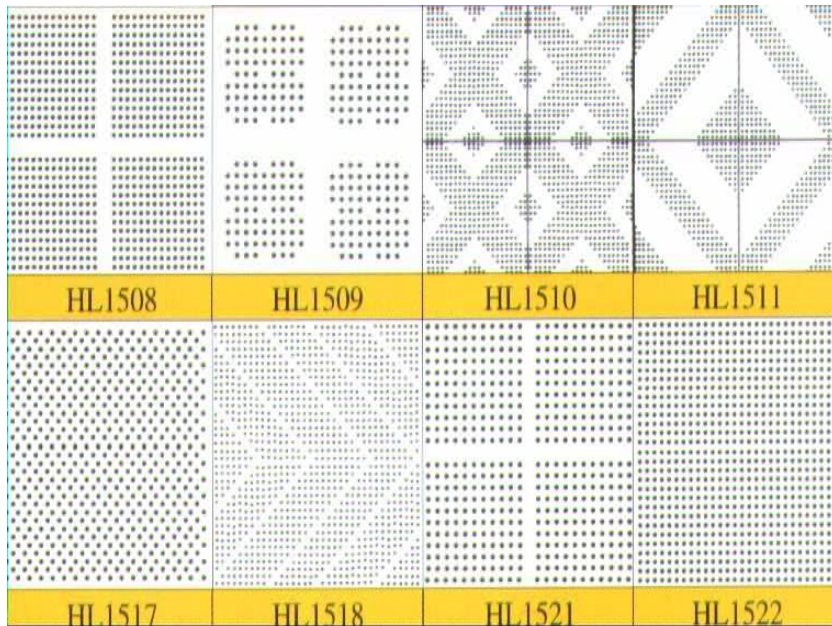


Application of non-asbestos fibre cement-roofing and pipe

International Asbestos Conference
Vienna, Austria, 6-7 May 2014



Internal application of fibre cement flat sheet- siding and ceiling



External application of fibre cement flat sheet- curtain wall



Outdoor furniture

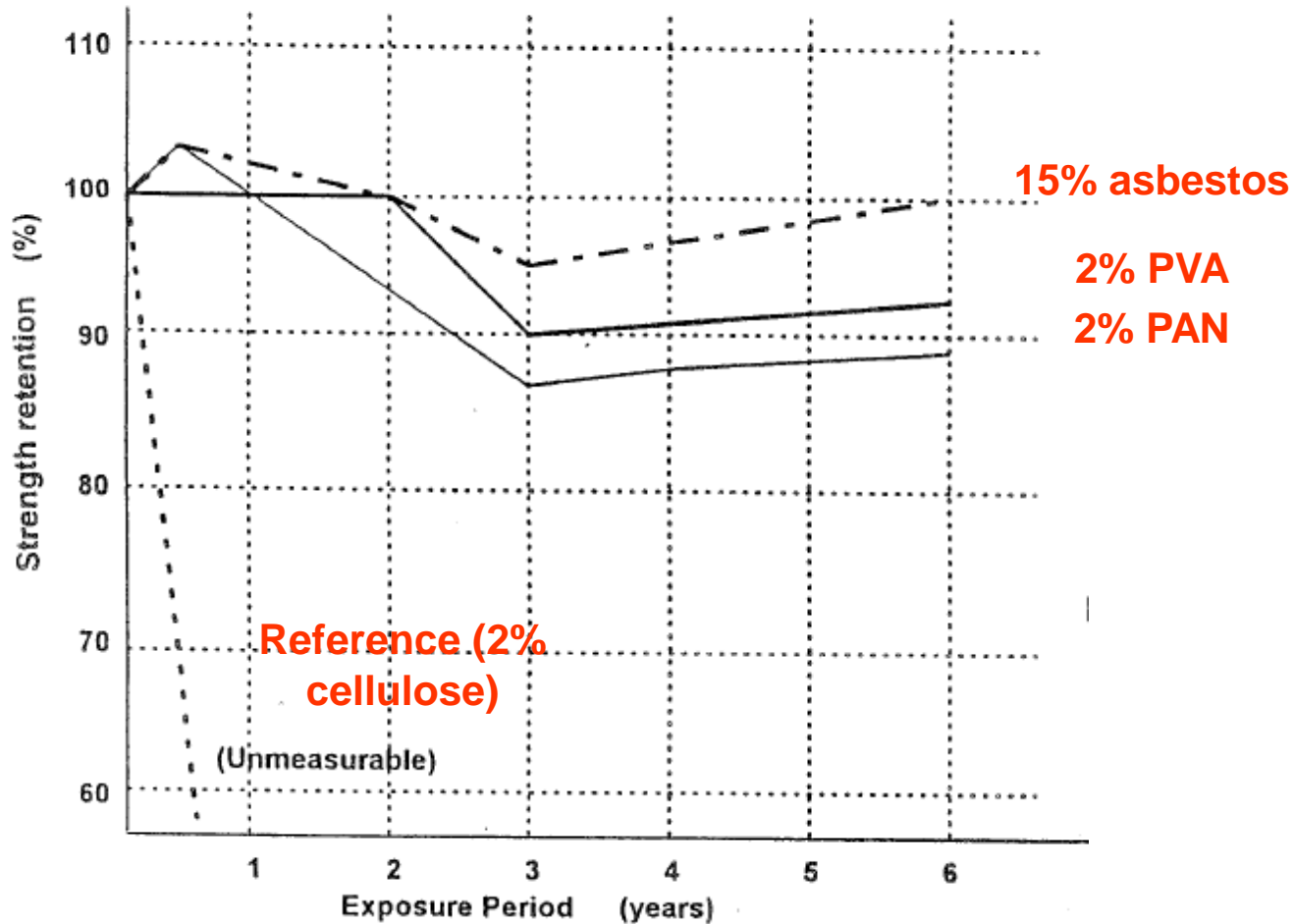


Architectural decoration by Glass reinforced cement product

Especially suitable for architectural decorative components and landscape decorative art works.

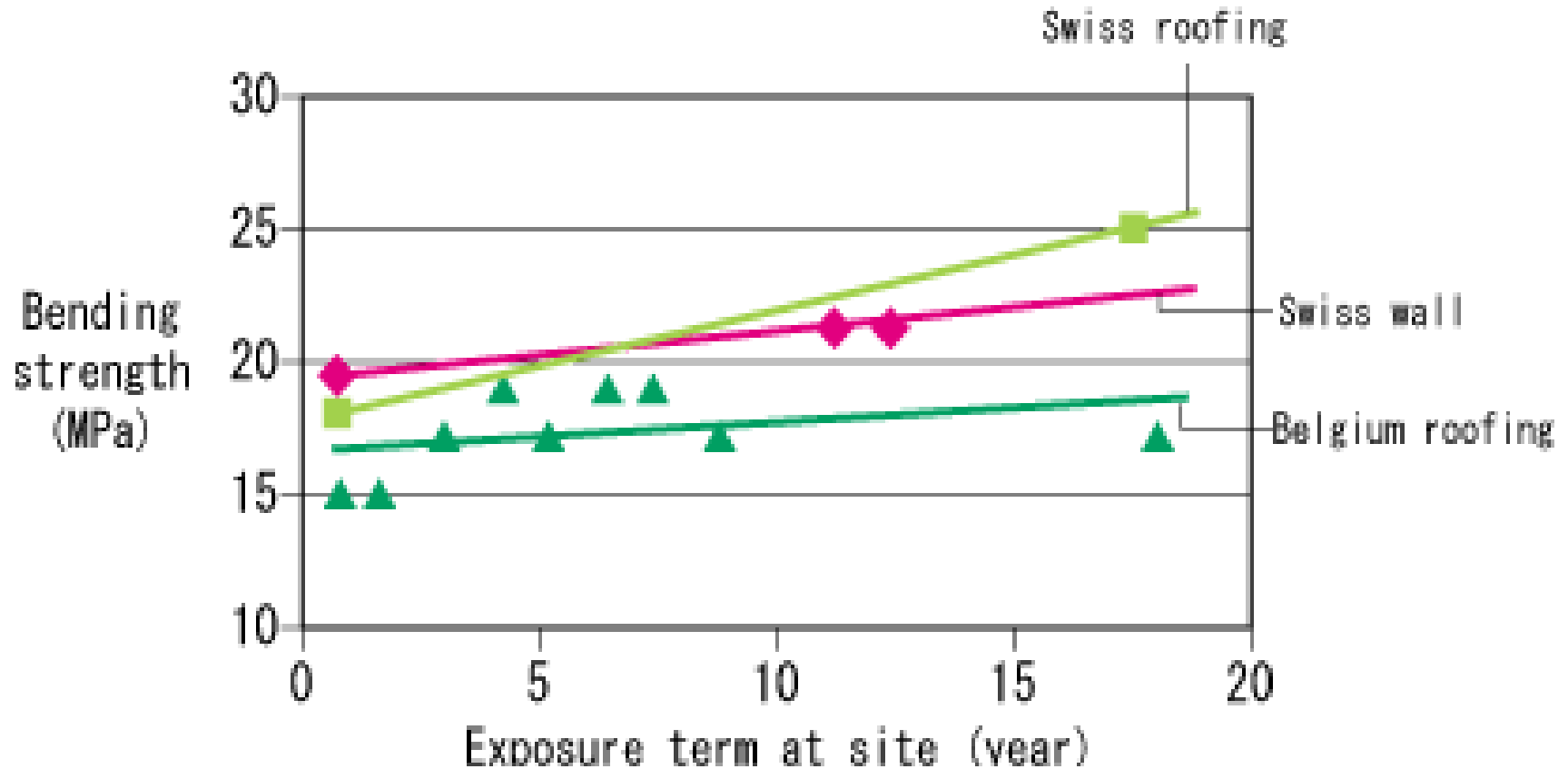


Weatherability of flat sheets (Japan)



Source: Kuraray Co. Ltd

PVA-reinforced FC sheets have survived 20 years of exposure without the loss of strength



Converting from asbestos to non-asbestos – Recipe cost

- It is difficult to give a general figures, since raw materials costs and product specifications differ significantly between regions
 - Raw materials price can vary.
 - Building codes (strength requirements) are different
 - Environmental requirements vary
 - Frost resistance is a major concern in Europe, but hardly in Thailand
- The following is a calculation for a recipe in an industrialised country with high durability requirements

Cost of mix fibre cement boards – European cost level

AC->FC, increased ~46%

Non-asbestos formulation

Raw material	Component kg/MT mix	Unit price, €/kg	Cost in mix €/MT	%
Cement	900	0.100	90	43.9
PVA fibres	20	4.0	80	39.0
Silica fume	50	0.40	20	9.8
Cellulose	30	0.50	15	7.3
SUM	1000		205	100 %

Asbestos formulation

Raw material	Component kg/MT mix	Unit price, €/kg	Cost in mix €/MT	%
Cement	900	0.100	90	64.3
Asbestos, # 4	100	0.50	50	35.7
SUM	1000		140	100 %

Cost of mix fibre cement boards – Chinese cost level

AC->FC, increased ~16.5%

Non-asbestos formulation

Raw material	Component kg/MT mix	Unit price, €/MT	Cost in mix €/MT	%
Cement	797	40	32	31%
Cellulose	35	577	20	19%
Limestone	100	12	1	1%
HM PVA	18	2076	37	36%
Microsilica	50	271	14	13%
Sum	1000		104	

Asbestos formulation

Raw material	Component kg/MT mix	Unit price €/MT	Cost in mix €/MT	%
Cement	828	40	33	37%
Asbestos	100	346	35	39%
Waster paper	12	115	1	2%
Glass fibre	10	288	3	3%
Sepiolite	50	346	17	19%
Sum	1000		90	

- Again, there are large regional variations
 - In China, India, SEA tradition with small machines, many workers
 - In Europe, larger machines, more automated
- Conversion means some significant changes in equipment
 - New equipment for cellulose pulping and mixing
 - Dosage systems for silica fume and possibly fillers
 - New mixers and pumps due to larger water circulation
 - Autoclave and energy cost if you choose Autoclaved product.
- Construction time for a large new production line: 1~2 year
- No major change in manpower required

Investment cost for FC production lines

Location	Description	Capacity	Investment	Remarks
Europe	New Hatschek	60,000 tpy	~ 10 mill. €	
China	New Hatschek	60,000 tpy (theoretical)	<1 mill. €	Chinese machinery, little automation

Trends in Asia

- Trend: Several plants in Asia are establishing new non-asbestos production lines
 - Japan (whole industry converted to N/A)
 - Korea (NA)
 - Thailand (several companies, developing)
 - China (developing)
 - Vietnam (developing)
 - India (start to move)
- Drivers:
 - Authorities, asbestos ban
 - Export to EU and other countries.
 - General public awareness, market does not want asbestos
 - Foreign investors, Tourism

Development of Non-asbestos product in China

- Asbestos product was not allowed in the most of important and well-know projects, such as 2008 Beijing Olympic game; 2010 World Expo in Shanghai, 2010 Asia game in Guangzhou and etc.
- Government also consider to get rid of asbestos product in the construction. Asbestos was forbidden to be used according to one new Chinese national standard Uniform Technical Code For Wall Materials Used In Buildings , which was published and implemented since 1st of June 2011(GB50574-2010) .
- Asbestos was classified as toxic and hazardous product according to the government document 'List of recommended substitutes for toxic and hazardous raw materials-2012' , asbestos was listed in the class 3 as the no.81 material, and High module and high strength PVA fibre was promoted as the substitute fibre. (Ministry of industry and information technology of the People's republic of China, Dec 27 2012.)
- Both of Asbestos and non-asbestos product has been producing in China today, however the industry was moving towards non-asbestos gradually.

Conclusions

- Technology for non-asbestos building products is readily available
- Cost of fibre cement recipe will increase, however this gap in China and SEA was reduced gradually because the price to import asbestos was increased with years.
- The market effect of conversion depends on several factors
 - General asbestos ban, increased price of Asbestos
 - Competition with other building systems
- Switch to non-asbestos products also give opportunities
 - New products
 - New application
 - Export possibilities

Thanks you

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