THE DEVELOPMENT OF NON-ASBESTOS FIBRE CEMENT IN CHINA

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ABSTRACT

With the high speed development of the Chinese economy, the building materials market is developing rapidly. Today, people hope to get better technical, 'green' products that are environmentally friendly. Asbestos cement products have existed in China with few alternatives for a very long time but that situation has changed. More and more factories are beginning to focus on the development of non-asbestos, fibre cement products. Some of them only produce non-asbestos products today. Elkem Microsilica® has been extensively used in non-asbestos fibre cement products to improve a wide range of properties and the benefit of using Microsilica has been recognized widely by the industry. Elkem has been working closely with manufacturers in many different parts of the world and in the case of China, Elkem established a professional fibre cement and quality control laboratory in Beijing. This has enabled Elkem to work closely with Chinese producers, helping them to develop non-asbestos fibre cement products in a relatively short time. Chinese non-asbestos fibre cement products and their markets have developed rapidly and successfully. In this paper, the story of the successful development of Chinese non-asbestos fibre cement products and the role of Elkem in providing technical solutions and support are discussed.

KEYWORDS:

Non-asbestos, fibre cement, China, Elkem

INTRODUCTION

In consideration of the health hazard of asbestos dust, more and more countries banned the use of asbestos; as a result much Asbestos cement (AC) production converted to non-asbestos production. In China, even the AC product was not bannedofficially,non-asbestos fibre-reinforced cement products have been successfully developed. Elkem fibre cement lab has been involved deeply in this convertingsince 2002 in China, we witnessed therapidly development of fibre cement industry in China. In this paper, the story of the successful development of Chinese non-asbestos fibre cement products and the role of Elkem in providing technical solutions and support are discussed.

CHINAFIBRE CEMENT PRODUCTION

Even though asbestos (Chrysotile) fibre cement is still produced and used in China, the non-asbestos fibre reinforced cement productsare still being developed successfully.Table 1 was the statistic data of China fibre cement production in 2006 and 2013 [1,2,3].Fig 1 shows the comparison of the annual production in 2006 and 2013. It was shown that annual production capacity was increased from 380 million sqm to 680 million sqmduring 2006 to 2013; furthermore the distribution of different product was also changed. Fig 2 was the distribution of asbestos fibre cement product (AC) and non-asbestos fibre cement product (FC)in 2006 and 2013.It was indicated that thevisibleincrease of non-asbestos share among the whole volume, it was increased from 8% to 18% during 2006 to 2011.Volume of flat sheet was increased quickly, and asbestos corrugated

sheet was dropped a lot almost decreased more than 30% from ~300 milionsqm to ~200 million sqm annually during 2006 o 2013. More and more producers start to convert to non-asbestos product and most of new producers will only consider non-asbestos product.

Table 1 – Statistic number of China AC/FC production in 2006 and 2013 ($\times 10^6 m^2$)

Year	2006	2013
Asbestos Corrugated sheet	300	200
Asbestos flat sheet	50	360
Non-Asbestos flat sheet	30	120
Total	380	680

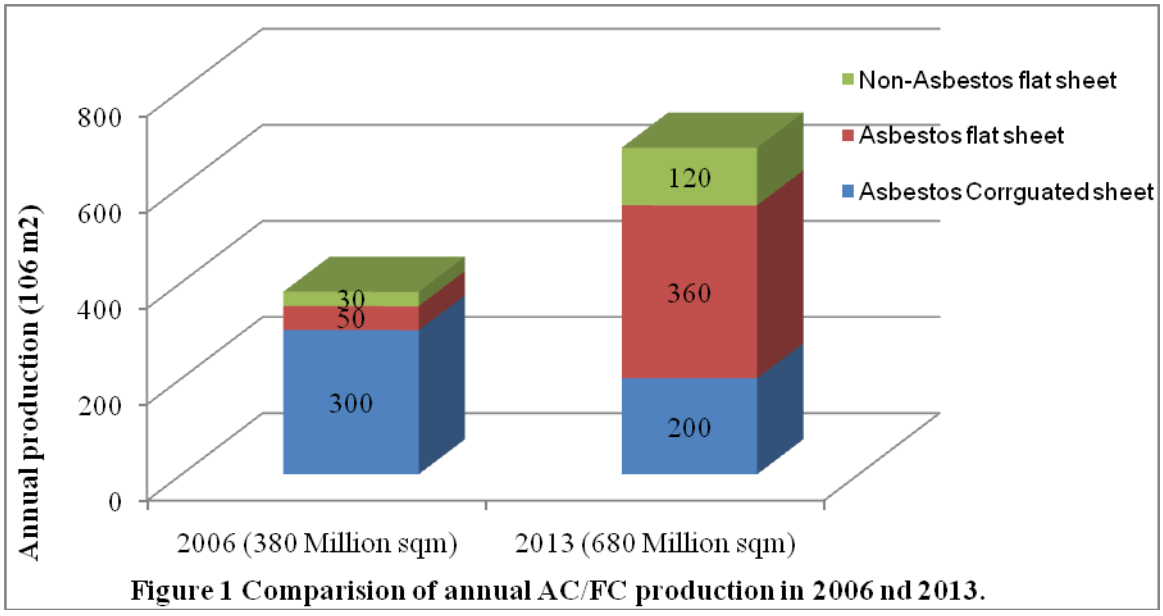

Figure 1 Comparision of annual AC/FC production in 2006 nd 2013.

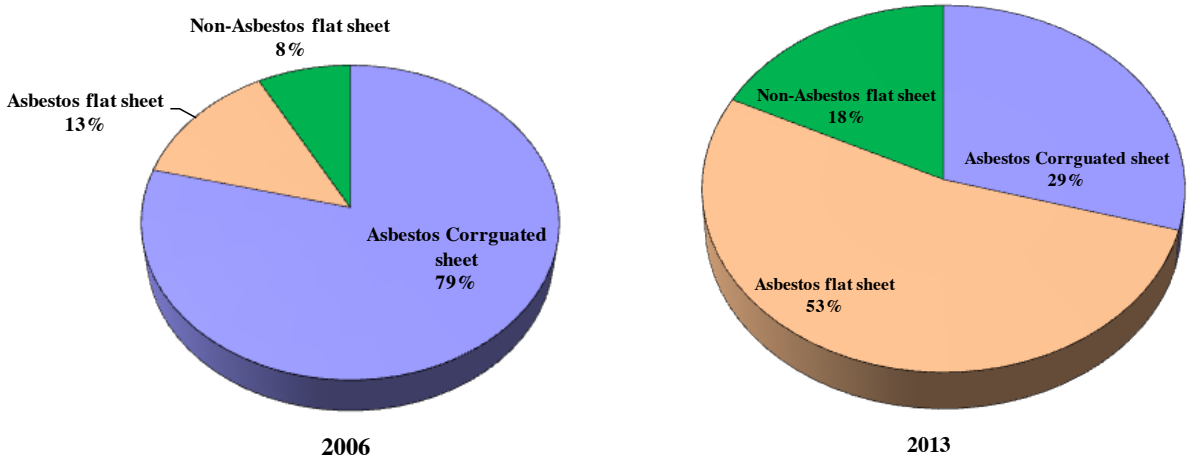

Figure 2 Distribution of AC and FC of China fibre cement production

TEST RAW MATERIALS AND RELATED TECHNOILOGY

Though asbestos-containing products have not been banned in Chinayet, the non-asbestos fibre cement productsare still being developed successfully in China,mainly autoclaved cellulose fibre reinforced cement board, glass fibre reinforced cement (GRC), and PVA fibre reinforced cement. During the converting to non-asbestos product, many raw materials and additives were tested in China. Elkem has been helping many factories to develop non-asbestos product with local raw materials.Here are some test results shown as below.

There was an example about one testto compare the effect of different additives on the air-cured non-asbestos fibre cement.Microsilica, fly ash, limestone, bentonite, rice husk ash and metakaolin were studied by Elkem technical centre.Recipe of the test was listed in table 2. Strength was shown in the figure 3.

Table 2 Recipe Effect of different additives on the air-cured non asbestos fibre cement recipes %

Sample ID	Cement40	Metakaolin (MK)	Microsilica (MS)	Rice Husk Ash(RHA)	Fly Ash (FA)	Diatomite (Dmt)	Limestone (LM)	Bentonite	Cement Bag Pulp	PVA Fibre A-8
E0	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0
E1	89.2	5.0	0.0	0.0	0.0	0.0	0.0	0.8	3.0	2.0
E2	89.2	0.0	5.0	0.0	0.0	0.0	0.0	0.8	3.0	2.0
E3	89.2	0.0	0.0	5.0	0.0	0.0	0.0	0.8	3.0	2.0
E4	84.2	0.0	0.0	0.0	10.0	0.0	0.0	0.8	3.0	2.0
E5	89.2	0.0	0.0	0.0	0.0	5.0	0.0	0.8	3.0	2.0
E6	84.2	0.0	0.0	0.0	0.0	0.0	10.0	0.8	3.0	2.0

It was shown from the figure 3 that the effect of different additives on the bending strength of sample, it was indicated the sample with 5% Microsilica got the highest strength among these additives.Besides the air-cured recipe, we also made test about the non-asbestos fibre cement product with Autoclaved technology. Figure4

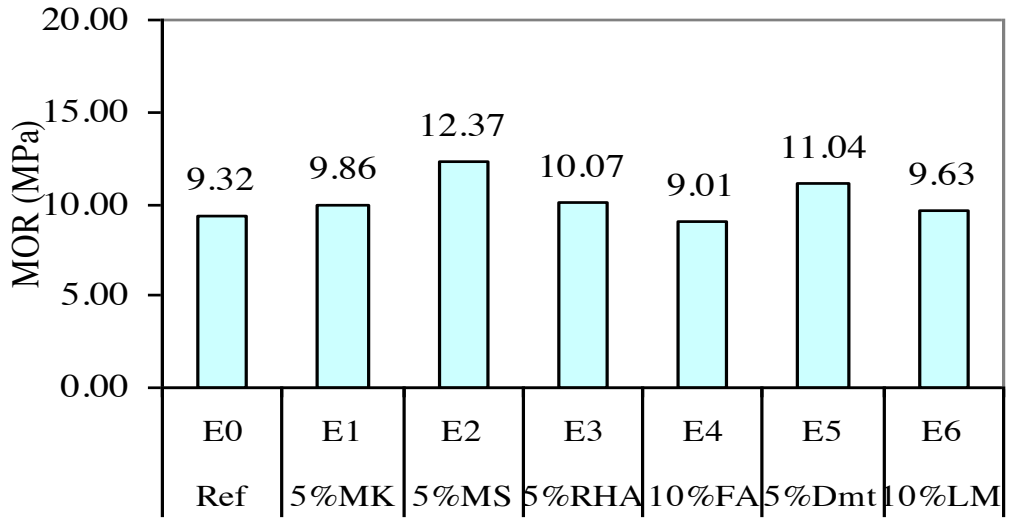

Figure 3.Bending strength of the sample with different additives

was the bending strength result about one test regarding the autoclaved product. Different cellulose and Microsilica was used in the recipe, it was shown from the figure 4 that the strength reinforcement was also effect by the cellulose type besides the Microsilica. Regarding the effect of Microsilica on the non-asbestos fibre cement, it was discussed in many papers [4,5,6,7,8,9]. Besides the Microsilica, we also evaluate the fibre

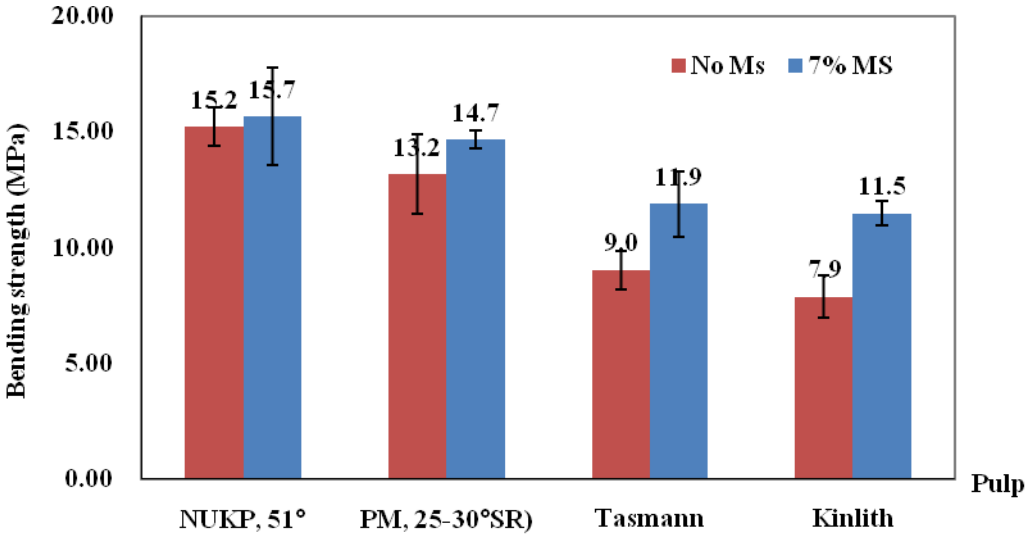

Figure4. Bending strength (MPa)

cement, it was discussed in many papers [4,5,6,7,8,9]. Besides the Microsilica, we also evaluate the effect of other additives and cellulose on the non asbestos fibre cement according to the requirement from the local market in China. Table 3 is a list that summaries the effect of different additives on the non-asbestos fibre cement product [10].

Table 3 Some tested additives and its effect on non-asbestos fibre cement product in China

Additive	Function in fibre cement production
Microsilica®	Increase the strength and durability, improve the problem of delamination
Mica	Improve the volume stability and reduce the drying shrinkage.
Limestone	Improve the durability and reduce the shrinkage
Fly ash	Part replacement of siliceous raw materials for saving cost. It might give contribution in the strength, but quality of fly ash was very variable and difficult to control.
Rice husk ash	Could increase strength and other performance as its quality was controlled in good way.
Wollastonite	Adjust the fibre cement slurry property, as well as some contribution to reduce the drying shrinkage.
Sepiolite	Adjust the fibre cement slurry for easy control during Hatschek process.

Diatomite	Part replacement of siliceous raw materials for saving cost, sometimes could adjust the FC slurry property.
Bentonite	Adjust FC slurry property.
Vermiculite	Used for light density product.
Perlite	Used for light density product
Flocculent	Polyacrylamide polymer product normally, it's mainly used to adjust the FC slurry for easy picking up and reduce the particles lost during the Hatschek process.
Defoamer	Generally used to avoid too much foams in the FC slurry, which might be created by the waster papers or off-grade PULP.

APPLICATION OF NON-ASBESTOS FIBRE CEMENT PRODUCT IN CHINA

Today more and more non-asbestos fibre cement was used in the construction in China, especially the flat sheet and its application has been developed fast. Application of non-asbestos flat sheet was used for siding, ceiling, floor, furniture and etc. in the construction. Here are some exampleswere introduced in the paper.

Figure 5 is the decoration style of internal siding at one subway station in Shanghai of China. It was used autoclaved non-asbestos fibre cement sheet for the siding materials. Besides the internal siding application, fibre cement was also used for the external siding. Figure 6 is a curtain decoration of a hall, it was made by autoclaved fibre cement sheet. Besides the siding application, fibre cement flat sheet was also used for ceiling

Figure 5: Internal application of fibre cement sheet

Figure 6: External siding of fibre cement sheet cement product

floor and external furniture. Figure 7 shows the style of the fibre cement ceiling product, and figure 8 was an example of external furniture in the garden, which was made of fibre cement product. In China, application of fibre cement became more and more popular, and its application was also developed well.

Figure 7: Fibre cement ceiling and external furniture product

DEVELOPMENT OF INDUSTRY STANDARD AND POLICY IN CHINA

With the development of non-asbestos fibre cement product and its application, Chinese industry and producer have made change accordingly. Green concept and environment friendly product was emphasized more and more in the fibre cement product in China today. Asbestos product was not allowed in the most of important and well-known projects, such as 2008 Beijing Olympic game; 2010 World Expo in Shanghai, 2010 Asia game in Guangzhou and etc. Chinese standard and related industry code has been modified accordingly too. Such as the new national standard GB50574-2010,Uniform Technical Code For Wall Materials Used In Buildings, which was published and implemented since 1st of June 2011, asbestos was ban in this code. 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 PVA fibre was promoted as the substitute fibre. (Ministry of industry and information technology of the People's republic of China, Dec 27 2012.). It was shown from these policy that the non-asbestos is the development direction of fibre cement.

ELKEM SERVICE AND FIBRE CEMENT TECHNICAL SUPPORT CENTRE IN CHINA

Elkem has been always to work with the fibre cement producer during the development of non-asbestos fibre cement product since asbestos wasbanned in Europe. Elkem started to supply Microsilica for non-asbestos fibre cement in the market since 1980's, and setup independent fibre cement technical centrein Beijing in 2003. Figure 8 was an overview of the lab. The technical centre was fullyequipped for non-asbestos fibre cement test, it was open laboratoryDuring the converting to the non-asbestos, Elkem fibre cementtechnical centrewas not only tested the raw materials for Chinese producer, but also offered the support on the standard

modification and share the industry information with producers. Today Elkem fibre cementtechnical centreis the one of the important industry groups in the field of fibre cement industry in China, and has widely industry contact globally.

Figure 8Overview of Elkem fibrecement technical centre

CONCLUSION

1. Non-asbestos fibre cement was developed widely and quickly in China. Its application has covered the siding, ceiling, floor, furniture and other elements in the construction.
2. Even though asbestos was not totally banned so far, Non-asbestos fibre cement was the development direction definitely in China.
3. Chinese industry standard and related code have been modified to fit non-asbestos development tendency.
4. Elkem fibre cement technical centre has been always helping to develop non-asbestos fibre cement product in this field, it is an important group among the industry groups in China too.

ACKNOWLEDGEMENTS

The authors would like to thank the following people for supporting this study and creating the paper.

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