



Competition  
Commission  
SINGAPORE

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## **Section 57 of the Competition Act (Cap. 50B)**

### **Grounds of Decision issued by CCS**

**Notification for Decision: Proposed acquisition by W.C.Heraeus GmbH (through Heraeus Materials Singapore Pte. Ltd.) of the bonding wire business of Kulicke and Soffa Industries, Inc.**

**26 September 2008**

**Case number: CCS 400/003/08**

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Confidential information in the original version of this Decision has been redacted from the published version on the public register. Redacted confidential information in the text of the published version of the Decision is denoted by [X].

## **I. INTRODUCTION**

1. On 2 September 2008, CCS received a notification for decision pertaining to the proposed acquisition (the "Transaction") of the bonding wire business of Kulicke and Soffa Industries, Inc ("K&S") by W.C.Heraeus GmbH ("WCH"), through Heraeus Materials Singapore Pte. Ltd (collectively referred to as "the Parties"). WCH is a subsidiary of Heraeus Holding GmbH ("Heraeus"), which is a privately owned precious metals and trading group headquartered in Germany.
2. CCS has concluded that the Transaction, if carried into effect, will not infringe the section 54 prohibition.

## **II. THE PARTIES**

3. K&S is a supplier of semiconductor assembly equipment, tools and materials and has a business unit dedicated to bonding wire. The bonding wire business of K&S and its wholly owned subsidiaries ("KSBW") is being acquired by WCH. KSBW manufactures and sells gold, copper, aluminium, and other types of specialty bonding wire. KSBW has manufacturing sites in Singapore and

Switzerland.

4. K&S also supports a research and development program and maintains a global network of sales offices, technical representatives and distributors. In addition to its bonding wire manufacturing facility, K&S also has a regional sales and customer support centre in Singapore and a wire bonding equipment manufacturing facility.

5. The core activities of WCH, the Heraeus subsidiary that is making the acquisition, include processing precious metals (gold, silver, platinum and other platinum group metals) to produce industrial products for the automotive, semiconductor, electronics and medical industries. WCH manufactures bonding wire in Germany, South Korea, China and the Philippines. WCH is also active in precious metals trading. WCH does not have bonding wire business operations in Singapore.

6. WCH has a subsidiary in Singapore, Heraeus Materials Singapore Pte. Ltd. The core activities of this business unit include the manufacturing and selling of high performance Sputtering Targets and Materials for all types of physical vapour deposition coating equipment. The Sputtering Targets and Materials are used in a variety of different products, including semiconductor devices, data storage media, architectural glass and flat panel displays. Other business activities include the trade, purchase, sales, import, export and storage of the following goods and services: Chemical products, Recycling, Catalysts, Engineered materials, Special metals, Precious metals, Precision technology, Assembly materials, Bonding wire, Thin Film materials, Thick Film materials, Ceramic Colours, Arc and Flash lamps and IR and UV lamps.

### **III. THE TRANSACTION**

7. The Transaction entails a cash offer for certain identified assets and liabilities of the bonding wire business of K&S and several of its wholly-owned subsidiaries, Kulicke & Soffa Global Holding Corporation, a company organised and existing under the laws of the Federal Territory of Labuan, Malaysia ("GHC"); Kulicke & Soffa (S.E.A.) Pte. Ltd., a corporation organised and existing under the laws of Singapore ("SEA"); and Müller Feindraht, AG, a company organised under the laws of Switzerland ("Müller") (collectively the "Seller Parties"). The assets of the Seller Parties that are located in Singapore are owned by GHC and SEA. Amongst other matters, completion of the Transaction is subject to obtaining required consents, approvals and waivers from government entities.

8. The Transaction constitutes a merger under section 54(2)(c) of the Competition Act (the "Act").

### **IV. COMPETITION ISSUES**

9. There is overlap in the Parties' respective bonding wire businesses. It is therefore necessary to consider if the Transaction will lead to the risk of non-

coordinated or coordinated effects that would substantially lessen competition in the markets for the sale of bonding wire.

10. As WCH is also involved in the precious metals trading business which constitutes an upstream market relative to the bonding wire business, it is therefore necessary to consider if the Transaction will lead to non-horizontal concerns, such as foreclosure of competition in the bonding wire market.

## **V. RELEVANT MARKETS**

### **Product Market Definition**

#### **Parties' submission**

11. Bonding wire is a material used primarily by Integrated Device Manufacturers to interconnect integrated circuit ("IC") dies and package substrates to create electronically conductive package ICs. "Bonding wire" is to be distinguished from "wire bonding", which is a method of making interconnections between a die and the substrate as part of semiconductor device fabrication. In other words, in the process of wire bonding, a fine wire, usually 1 to 3 mil (where one (1) mil is equal to 25.4 micrometers) in diameter, is used to complete an electrical connection in an electronic device.

12. Bonding wire is typically produced in different dimensions to satisfy different bonding requirements but this does not require a further narrowing of the market by reference to specific dimensions since all manufacturers produce a wide range of dimensions.

13. Wire bonding is used for a wide variety of products, ranging from transistors to advanced packages. Devices that use wire bond technology include memory, analog, microprocessors, application specific ICs, programmable logic devices, and digital signal processors for personal computer, cellular telephone, digital still cameras and digital video camera end market applications. The wire is bonded at both ends using some combination of heat, pressure, and/or ultrasonic energy to make a weld and become a permanent fixture in the semiconductor package. Bonding wire is a direct material consumable used in the production of IC packages and not a component of semiconductor capital equipment.

14. There are three main types of wire used in the bonding process: gold, copper and aluminium. Gold bonding wire is used for all types of applications and is considered the fastest and easiest type of bonding wire to use. Gold bonding wire is resistant to corrosion, and is also malleable, inert and has excellent electrical conductivity. It is utilised in a wide variety of IC applications. WCH estimates that gold bonding wire reflects approximately 94% of the total bonding wire market by volume (measured in meters). K&S estimates that gold bonding wire represents more than 99% of the total bonding wire market by value.<sup>1</sup>

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<sup>1</sup> The global market values for gold, copper and aluminium bonding wires in 2006 were [X],[X] and [X]

15. Currently, the primary application for copper bonding wire is confined to (1) power applications using large diameter wires (2 mil and above) for both discrete and integrated devices where the bond pad structure is robust enough for copper wire bonding, and (2) low pin count applications using 1-2 mil diameter wire for discrete applications. Copper is more conductive and less expensive than gold, but it is not as malleable and is subject to oxidation concerns and therefore is more challenging to use mechanically, which limits its use. The Parties are aware that some customers are evaluating the use of copper wire in additional applications, targeted at high pin count IC packages with wire sizes below 1 mil, as well as other device applications, in light of gold price volatility in recent years. The costs of switching from using gold to copper, however, are substantial due to required changes in manufacturing processes and customer qualification efforts.

16. Gold bonding wire and copper bonding wire comprise distinct product markets. While it is believed that customers will continue to explore possible opportunities for the substitution of copper bonding wire for gold bonding wire in suitable applications, this has no effect on the competition analysis since Heraeus does not sell copper bonding wire in Singapore.

17. Aluminium bonding wire is used for different applications from either gold or copper bonding wire and its surface oxidises and is more brittle as compared to gold and copper. Aluminium bonding wire can be divided into two types: (i) heavy bonding wire used for higher power applications; and (ii) fine aluminium which is used for low-end consumer products such as toys and watches. Fine aluminium wire is sold as a commodity through distributors rather than directly sold by producers. Aluminium bonding wire is not substitutable with copper or gold bonding wire.

18. For the foregoing reasons, the Parties submit that gold, copper and aluminium bonding wire constitute separate product markets, and these wire types are distinguishable by their metal type, application and price differences.

19. The product overlap between the Parties in Singapore is limited to gold bonding wire, as KSBW's sales of copper bonding wire and aluminium bonding wire in Singapore are minimal. Therefore, the Parties' view is that the competitive assessment may be limited to the gold bonding wire market for purposes of assessing the competitive impact of the proposed transaction in Singapore.

#### CCS' assessment

20. CCS inquiries showed that gold, copper and aluminium bonding wires are used in different types of product applications. While there has been some substitution of demand from using gold to copper bonding wire (primarily due to the rising cost of gold), substitutability between the two types of materials is still limited, and is currently found only in certain small number of product

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respectively. Figures provided by the SEMI Global Semiconductor Packaging Materials Outlook 2007.

applications where technology permits.

21. Based on the information provided, CCS agrees with the Parties that gold, copper and aluminium bonding wire constitute separate product markets. These markets also do not need to be further narrowed down according to other wire characteristics (e.g. diameter, shape, and purity) for the purpose of the assessment here.

22. CCS considers that it is still relevant to assess the competition impact of the Transaction on the copper and aluminium bonding wire markets as the bonding wire markets have global characteristics (as explained in later paragraphs) and WCH is a competitor to KSBW in the global copper and aluminium bonding wire markets before the Transaction.

### **Geographic Market Definition**

#### **Parties' submission**

23. WCH produces gold wire in Germany, Korea, the Philippines and China. It imports gold bonding wire into Singapore from its facilities in Germany. KSBW imports gold bonding wire from its Switzerland facility for sale in Singapore and also produces gold bonding wire in Singapore for domestic sale. WCH produces copper bonding wire in Germany, Korea and China but it had no sales of copper bonding wire in Singapore in 2007. K&S manufactures copper wire in Singapore and Switzerland. KSBW manufactures aluminium bonding wire in Switzerland and Singapore, but all KSBW sales of aluminium wire to Singapore are manufactured in its Singapore facility. WCH produces aluminium bonding wire in Germany, Korea and China, but it had no aluminium bonding wire sales in Singapore in 2007.

24. The Parties submit that the market for bonding wire has global characteristics. Among these global characteristics, trade patterns for bonding wire reveal that geographically dispersed producers of bonding wire sell their products to customers worldwide.

25. More specifically, apart from the two regional suppliers, Yuh Cheng Metal Corp. and Heesung Metal Ltd. ("Heesung"), there are currently six major global players, Tanaka Denshi Kogoyo K.K. ("Tanaka"), Sumitomo Metal Mining Co., Ltd ("Sumitomo"), KSBW, MK Electron ("MKE"), WCH, and Nippon Micro Metal ("Nippon"), who sell gold bonding wire on a global basis from their manufacturing operations around the world, all of whom compete in Singapore. For example, WCH has bonding wire manufacturing facilities in Europe, South Korea, the Philippines and China. With the exception of its China operation (which is subject to government-imposed export restrictions), WCH's facilities serve customers globally. Heraeus primarily services other South-East Asian countries from its facilities in Korea and the Philippines, including Indonesia, Singapore, Malaysia and Thailand. Likewise, KSBW's operations in Switzerland

and Singapore sell to customers throughout the world.

26. The Parties submit that it is unnecessary to determine whether the market is global or confined to Singapore because the transaction will not result in a substantial lessening of competition under either analysis.

CCS' assessment

27. It is necessary to consider whether the market is global. CCS found support for the Parties' claims that the market has global characteristics. Customers of bonding wire typically source for bonding wire on a global scale. The location of suppliers is usually not a concern to customers as transportation cost is insignificant compared to the value of the products. Based on the information provided by the Parties and information from third parties, CCS is of the view that the relevant market for bonding wire is global.

**Activities Upstream and Downstream to the Relevant Markets**

Parties' submission

28. WCH also engages in the merchant sale of precious metals, including gold, and thus operates upstream relative to the bonding wire business. However, WCH's share of the global gold metals trading market is less than 1%. Furthermore, WCH does not presently supply gold metal to KSBW and there are ample alternative sources of gold metal available to bonding wire competitors.

29. K&S designs, manufactures, and markets capital equipment and packaging materials used to assemble semiconductor devices. K&S also services, maintains, repairs and upgrades this equipment. This equipment consists of wire bonders and die bonders. Wire bonders are used to connect very fine wires between the bond pads of the die and the leads on its package. Die bonders attach a semiconductor device, or die, to the package which will house the device. Bonding wire is used with wire bonders and other bonding equipment but it is not a component in the equipment's production. Therefore the Parties are of the view that K&S' equipment business is "complementary to", rather than "downstream of" bonding wire.

30. The Parties have also confirmed that no company in their respective groups has any interest in any other company operating in the markets mentioned above.

CCS' assessment

31. Based on the Parties' submissions, CCS is of the view that the relevant markets for considering the non-horizontal effects of this merger are the upstream markets, i.e. the market for the supply of gold, the market for the supply of copper and that for the supply of aluminium. CCS' inquiries found that the main component of the price (about 95%) of bonding wires is the cost of the material (i.e. gold, copper and aluminium).

32. Based on the information provided by the Parties, to which no contrary feedback was received, CCS agrees with the Parties that these upstream markets are global markets.

## VI. MARKET STRUCTURE

### Market Share and Market Concentration

33. Table 1 below shows the global market share figures for (i) gold, (ii) copper and (iii) aluminium bonding wire in 2007.

Supplier	Estimated Global Market Share (%)		
	Gold wire <sup>(a)</sup> (by volume)	Copper Wire <sup>(b)</sup> (by volume)	Aluminium Wire <sup>(c)</sup> (by volume)
WCH	[0%-10%]	[0%-10%]	[0%-10%]
KSBW	[10%-20%]	[50%-60%]	[10%-20%]
WCH & KSBW	[20%-30%]	[50%-60%]	[20%-30%]
Tanaka	[30%-40%]	[20%-30%]	[10%-20%]
Sumitomo	[10%-20%]	Not Avail.	Not Avail.
Nippon	[10%-20%]	Not Avail.	Not Avail.
MKE	[0%-10%]	[0%-10%]	Not Avail.
Custom Chip Connection ("CCC")	Not Avail.	Not Avail.	[20%-30%]
Others	[0%-10%]	[10%-20%]	[30%-40%]
Pre-merger CR3	[60%-70%]	[80%-90%]	[50%-60%]
Post-merger CR3	[70%-80%]	[80%-90%]	[60%-70%]
Total	100	100	100

(a) Source: Credit Suisse's Confidential Information Memorandum for KSBW, Feb 2008.

(b) Source: Credit Suisse's Confidential Information Memorandum for KSBW, Feb 2008 and information provided by WCH.

(c) Figures in the column are derived by CCS using information provided by the Parties and the SEMI Global Semiconductor Packaging Materials Outlook 2007.

34. The following observations can be made from Table 1:

i) For aluminium bonding wire:

The Parties' post-merger global market share is below 40%, while the post-merger global CR3 is below 70%. These figures fall below the indicative thresholds under the CCS Guidelines<sup>2</sup>.

<sup>2</sup> The CCS Guidelines on Merger Procedures states that, "Generally, the CCS is unlikely to intervene in a merger situation unless:

- the merged entity will have a market share of 40% or more; or
- the merged entity will have a market share of between 20% to 40% and the post-merger combined market share of the three largest firms (CR3) is 70% or more."

ii) For gold bonding wire:

The Parties' post-merger global market share is below 40%. However, the post-merger global CR3 is above 70%. This, coupled with the fact that the post-merger global market share is above 20%, means that the second indicative threshold under the CCS Guidelines has been exceeded.

iii) For copper bonding wire:

The Parties' post-merger global market share is above 40% while the post-merger global CR3 is also above 70%. Both indicative thresholds under the CCS Guidelines have thus been exceeded.

### **Barriers to Entry & Expansion**

35. CCS' inquiries revealed that existing bonding wire suppliers can expand their presence in Singapore with relative ease since transportation cost is small relative to the value of wires. However, entry of an entirely new player into the global market may be more difficult as customers may still prefer to use more established suppliers. Some respondents also suggested that firms may not find it profitable to enter the global bonding wire market as it is already saturated with big established players.

36. Based on the [X], there appears to be some excess capacity in the bonding wire market. The information provided to CCS by respondents also revealed that suppliers can expand production quickly by extending work hours if there is an increase in orders.

### **Product Differentiation**

37. The information provided to CCS also revealed that bonding wires supplied by different suppliers are considered homogeneous commodities, where customers can switch easily from one supplier to another for the purchase of a particular type of basic wire.

### **Countervailing Buyer Power**

38. CCS' inquiries revealed that customers of bonding wires usually use more than one qualified supplier for a particular application. CCS also found that customers are generally in a good position to negotiate prices with bonding wire suppliers.

## **VII. COMPETITION ASSESSMENT**

### **Non-Coordinated Effects**

39. Non-coordinated effects may arise where, as a result of a merger, the merged entity finds it profitable to raise prices (or reduce output or quality) because of the loss of competition between the merged entities. Post-merger



market shares may give an indication of the market power possessed by the Parties post-merger and the probability that non-coordinated effects may arise.

40. As seen in **Table 1**, the Parties' post-merger market share falls below the indicative threshold under the CCS Guidelines (i.e. 40%), for the gold bonding wire and aluminium bonding wire markets.

41. While the Parties' post-merger global market share for copper bonding wire is [X]% and thus exceeds the threshold, KSBW already has a [X]% market share pre-merger. The market share increment of [X]% is thus slight. In light of all the facts of this case, it does not appear to result in any significant increase in market power insofar as the copper bonding wire market is concerned. Furthermore, the low barriers to expansion and buyer power may act as competitive constraints on the Parties.

42. Hence CCS is of the view that the Transaction is unlikely to give rise to non-coordinated effects in the relevant markets.

### **Coordinated Effects**

43. A merger may lessen competition substantially by increasing the possibility that, post-merger, firms in the same market may coordinate their behaviour to raise prices, or reduce quality or output. Coordinated effects may arise where a merger reduces competitive constraints in a market, thus increasing the probability that competitors will collude or strengthening a tendency to do so. Post-merger CR3 may give an indication of the possibility that coordinated effects may arise.

44. While the post-merger CR3 lies above the indicative threshold under the CCS Guidelines (i.e. 70%), for the gold bonding wire and copper bonding wire markets, the CCS notes that the increment in the CR3 for the copper bonding wire market resulting from the merger is slight, at only [X]%. In any case, comments from third parties indicated that the bonding wire markets, whether for gold or for copper, are very competitive and will remain so even after the Transaction. CCS' inquiries also reveal that the low barriers to expansion and buyer power in the markets may make it difficult for players in the markets to coordinate their behaviour.

45. Hence CCS is of the view that the Transaction is unlikely to give rise to coordinated effects in the relevant markets.

### **Non-Horizontal Issues**

46. Based on the information provided by the Parties, WCH is not involved in the trading of copper and aluminium metal. WCH's market share in the global gold metal trading market is also minimal; hence it is unlikely to possess market power in that market. Moreover, CCS also notes that WCH involvement in both the gold bonding wire market and the global gold metal trading market (upstream to the gold bonding wire market) existed before the Transaction.

47. Hence, CCS is of the view that there is unlikely to be any non-horizontal concerns arising from the Transaction.

## **VIII. ANCILLARY RESTRICTIONS**

48. The Parties have also notified ancillary restrictions entered into pursuant to the Transaction.

### **The MSPA Restrictions**

49. In the Master Sale and Purchase Agreement ("MSPA") entered into between the Parties, K&S agrees not to engage in the operation of any business that competes with the bonding wire business for a period of five years following the closing of transactions on or about 29 September 2008 (these arrangements will be collectively referred to as "MSPA restrictions").

### **Parties' submissions**

50. The MSPA restrictions are necessary to the implementation of the Transaction in order to provide assurance to WCH that K&S will not set up a competing business post-merger and thereby reduce the value of the assets acquired. The provision is important to protect the goodwill and know-how transferred by the MSPA.

### **CCS' assessment**

51. Ancillary restrictions are excluded from the section 34 prohibition and section 47 prohibition under paragraph 10 of the Third Schedule to the Competition Act. A restriction must be directly related and necessary to the implementation of the merger if it is to benefit from the exclusion. The criteria of direct relation and necessity are objective in nature. A restriction is not "directly related" if there is little or no connection with the merger. A restriction is likely to be "necessary" where in the absence of the restriction, the merger would not go ahead or could only go ahead at substantially higher costs, over an appreciably longer period, or with considerably more difficulty.

52. CCS is of the view that the MSPA restrictions constitute an ancillary restriction and consequently fall within the exclusion under paragraph 10 of the Third Schedule. The CCS Guidelines on the Substantive Assessment of Mergers state that non-compete clauses, if properly limited, are generally accepted as essential if the purchaser is to receive the full benefit of any goodwill and/or know-how acquired with any tangible assets. CCS will consider the duration of the clause, its geographical field of application, its subject matter and the persons subject to it.

53. CCS is of the view that on the facts of this case, five years is a reasonable amount of time for WCH to establish a reputation for reliability with K&S's customers separate and apart from that currently held by K&S, in the highly

technical semiconductor industry. CCS also notes that the Parties will no longer be competitors after the MSPA is completed as K&S is exiting the bonding wire business and WCH is not a participant in the bonding wire equipment business.

## **VI. CONCLUSION**

54. For the reasons stated above and based on the information available to CCS, CCS concludes that the Transaction, if carried into effect, will not infringe the section 54 prohibition.

55. In accordance with section 57(7) of the Act, this decision shall be valid for a period of 1 year from the date of this decision.



Teo Eng Cheong  
Chief Executive  
Competition Commission of Singapore

