

()

()

.

.

1.

2.

3.

4. 가

5.

6. 가 2

.

.

국문 요약

8

22%

가 .

,

가

가

가

가

.

: , , , .

I 서 론

가 10
3 . (, 1998: 60)

가

가

가 .

가

가 . (, 2002: 612,
, 2004: 9, , 2003: 264)

가 가

가 . (, 2002)

가

가 .

미세조직 분석

가 가 8

(Energy Dispersive Spectrometer: EDS)

100M \empty 30M \empty () 10g

1.

1a

1b

(EDS)

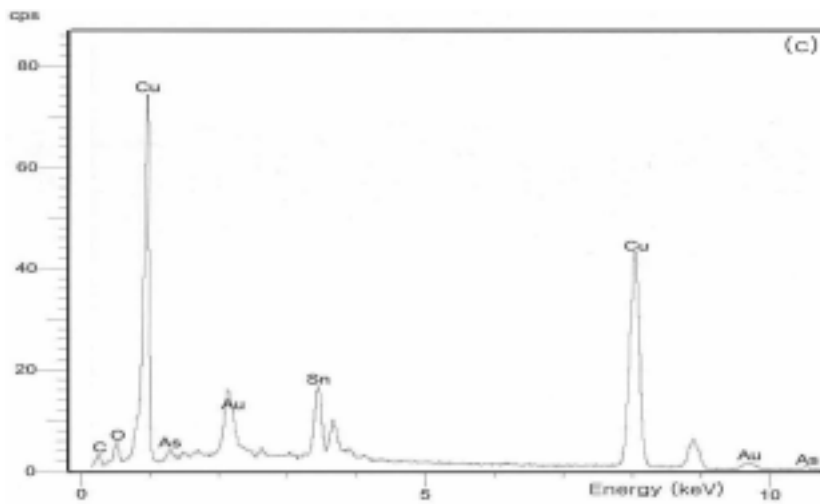
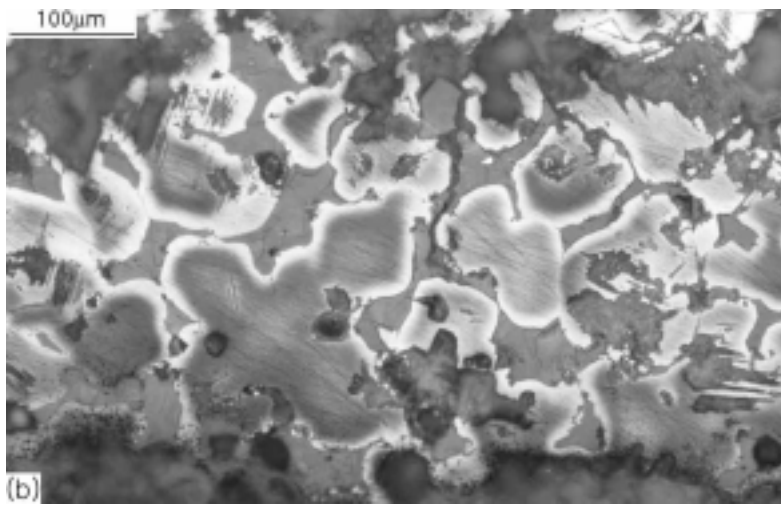
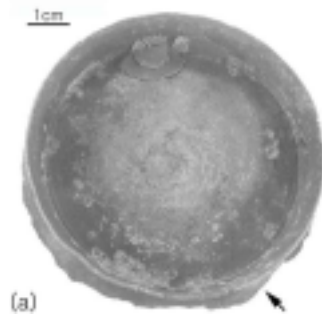
가

1b

(Cu)

(Sn), (As), (Au),

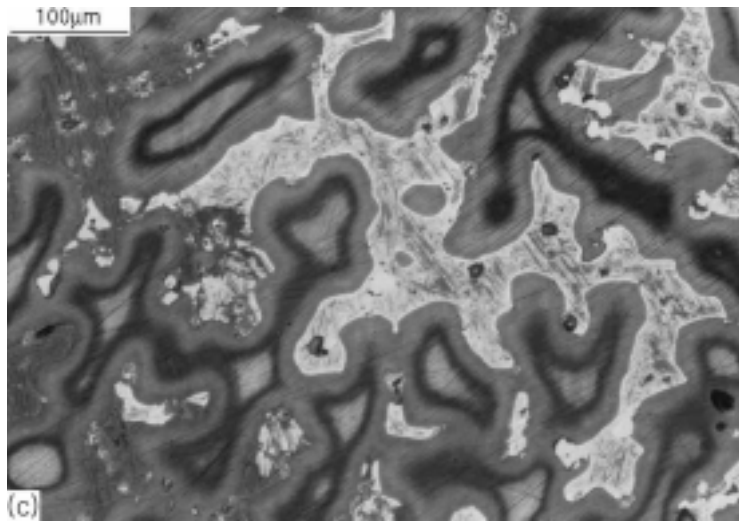
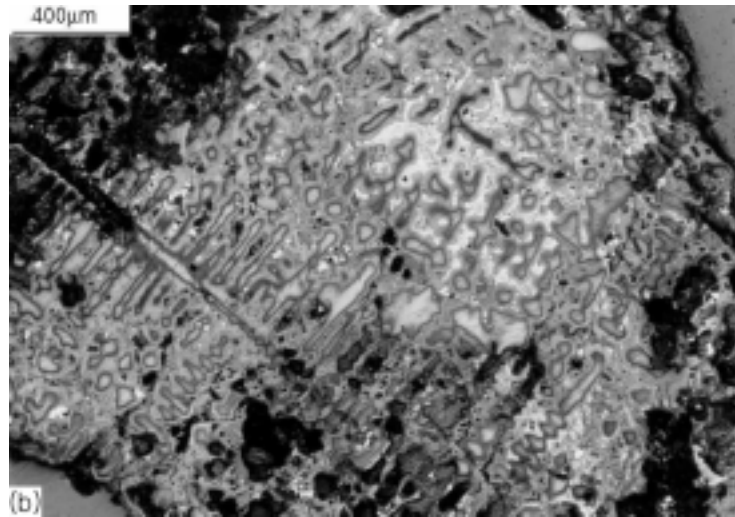
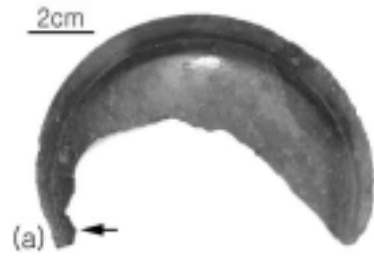
(O), (C) 가



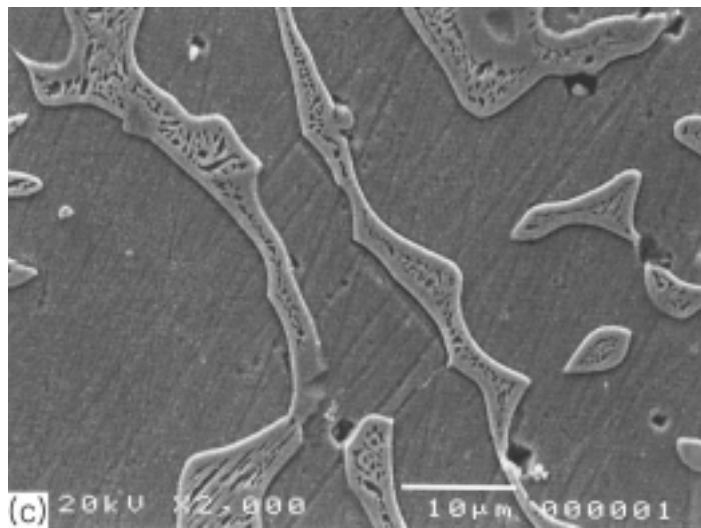
< 1>

(a) , (b) (a) ,
 (c) (b) EDS : 14.6% Sn, 8.7% As.

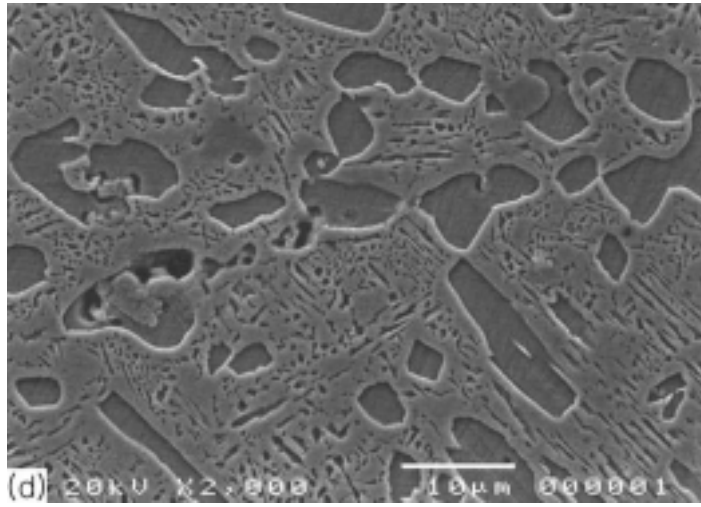
				14.6%	8.7%	가	1c	가
		가						
2.								
	2a						2b	
					2c			
	586							
	가					19.2%		10.1%
	가					가		
3.								
	3a			3b				
				가			1	2
				3c	3d			
				가			가	
		3c	3d					가
							가	
								10%



< 2> . (a) , (b) (a)
(c) (b) : 19.2% Sn, 10.1% As.



< 3> . (a) , (b) (a) : 16.6% Sn, (c) (b) 1



< 3> . (d) (b) 2 :
22.2% Sn.

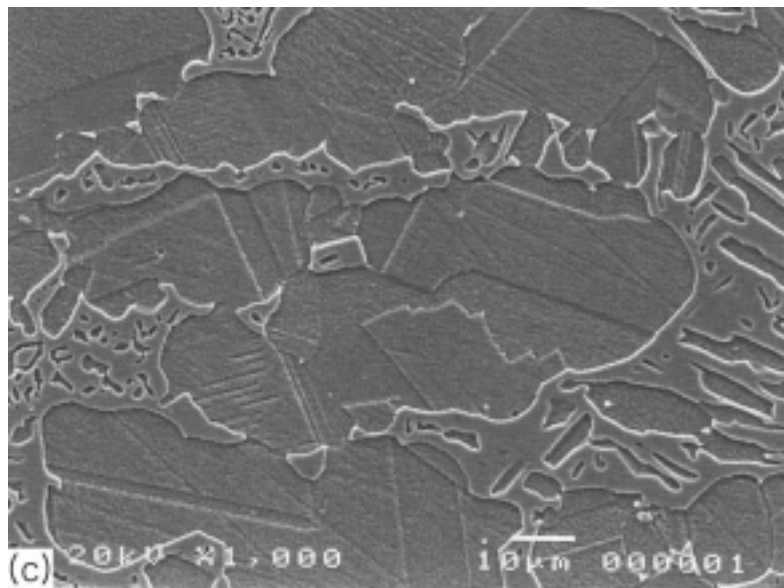
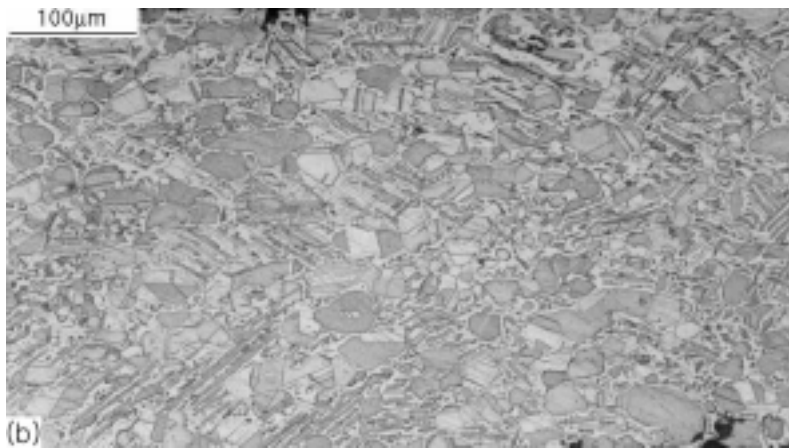
. 3c 3d 16.6% 22.2%
가 가

4. 가

4a 가 . 4b

. 4c 4b
가

21.6% 가



< 4> 가 . (a) , (b) (a)

(c) (b)

: 21.6% Sn,

5.

5a

5b

5c

520

586

가 가

20.3%

가

21.5%

가 가

6.

가 2

6a

가 2

가

6b

가

6c가

21.7%

22.4%

가

586

가

가

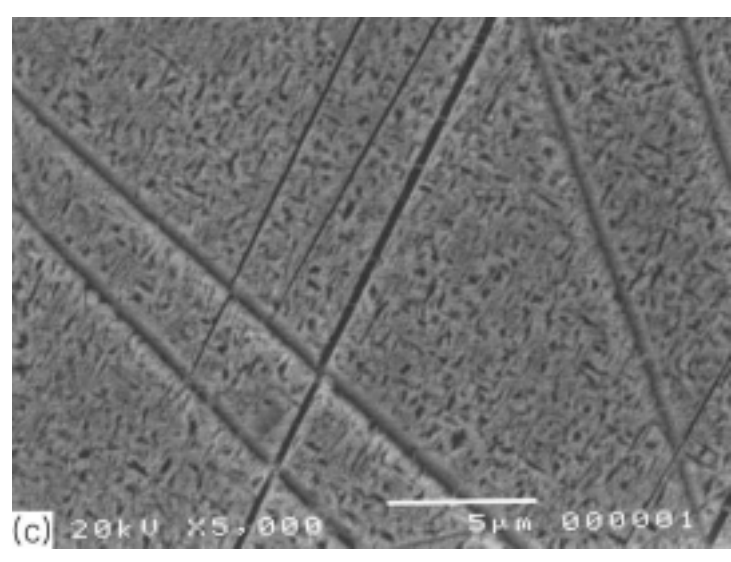
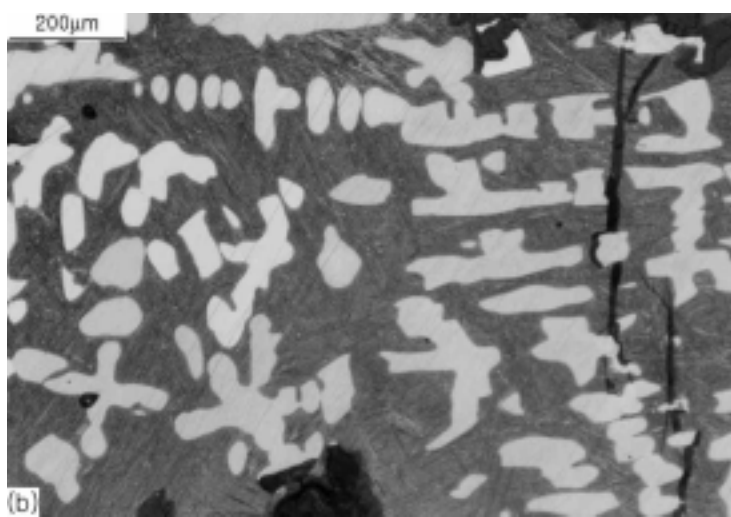
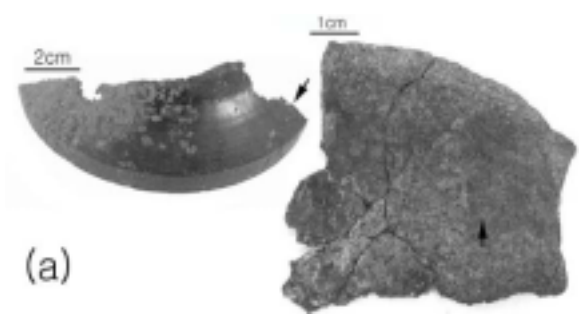
가

가

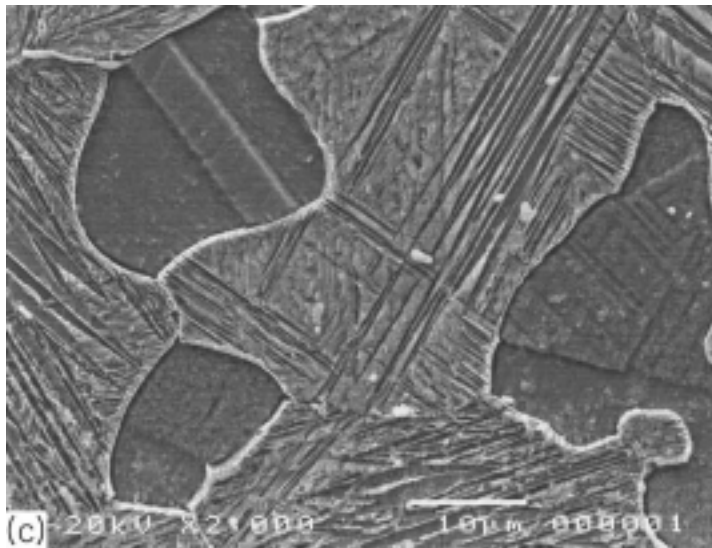
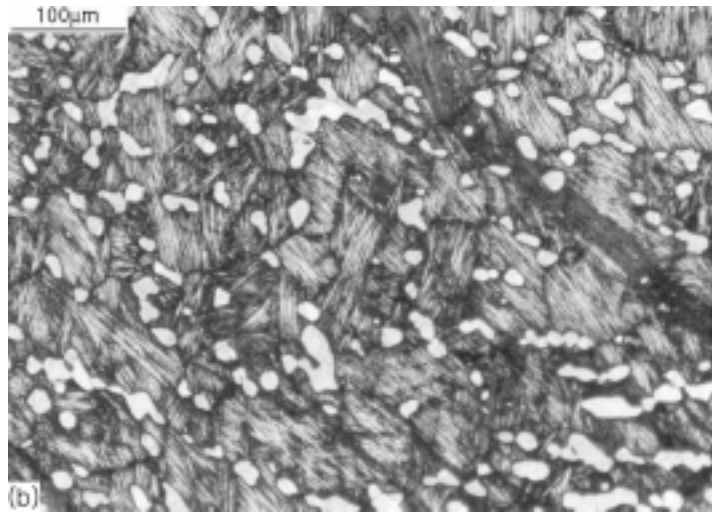
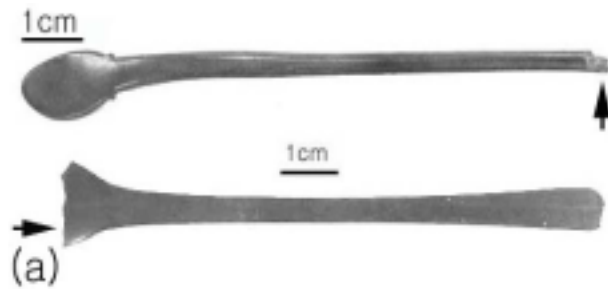
가

6b

6c



< 5> : 20.3% Sn, (b) (a) : 21.5% Sn, (c) (b)



< 6> 가 2 . (a) : 21.7% Sn : 22.4% Sn, (b) (a)
 , (c) (a) .

1

가 가

10%

22%

#1 #2

가

가

(, 1996: 25,

, 2002: 612,

, 2004: 9,

, 2003: 264)

가

10%

가

가

가

가

가

가

10%

22%

140

22%

가

가

가

(Pb)

가

가

#1 #3

가

가

가 1mm

가

가

#4

가 가 가 . 가 가

. #4 #2, #5 #6 가

#7 #8 #2, #5, #6 가

22% 가

(, 2002: 249, , 2004: 9, , 2003: 264)

가 가

(Hummel, 1999: 68, Smith, 1981: 244)

가 #1 #2 . #7

#8 가

< 1 >

#		[%]	[%]		
1		14.6	8.7		
2		19.2	10.1	-	586
3		16.6	ND*		
4	가	21.6	ND	-	
5		21.5	ND	-	520-586
6		20.3	ND	-	520-586
7	가	21.7	ND	- -	586
8	가	22.4	ND	- -	586

* ND :

가 가
가 , ,
.
가 가
가 .

요약 및 결론

22% 8
2 6 20%
가 가 .
가 3 , 가 1 , 가 가
2 2 가
20% ,
가 .
가 가 .
1mm
가 .
가 가 .
가 가
가 가
가 가
가 가
가 #7, #8 가

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Transitions in Bronze Technology Observed in Bronze Artifacts Excavated from the Shilla Wang-Gyong

Jeong, Young-Dong / Park, Jang-Shik

As an initial step to understand the transitions in Korean bronze technology the present study has examined metallurgical microstructures of 8 artifacts excavated from the Silla Wang-Gyong site in Kyongju. Important trends have been found in alloy compositions and also in manufacturing processes. In the design of alloys, the Sn content was apparently changing toward the peritectic point, 22 mass %, of the Cu-Sn phase diagram while the Pb addition was intentionally avoided. This trend in composition was found accompanied by the introduction, subsequent to casting, of such special thermo-mechanical treatments as quenching and forging in artifact manufacture. In addition, the Sn content in alloys containing a significant amount of As was relatively low and no evidence of forging was observed in them. The use of quenching and forging and the rejection of Pb and As from alloys are all necessary requirements if the brittle nature of high Sn alloys is to be overcome in bronze working. This paper will show that the Wang-Gyong era corresponds to that of innovations leading to the technical climax in Korean bronze tradition, which has been maintained up to the present.

Keyword : Bronze, Technology, Transition, Silla Wang-Gyong, Microstructure