Only within Copper Alloy W/G

Leaded Copper Alloy Test Result Summary (standard specimen)

2014 Oct 22

JAMA/JAPIA

1. Test Result (Overall)

Table 1 : Overall result

Pb (ave. %)	3.7	0.2	<0.1 (Si-type)
Material Property (chart 2)	Control	O	O/X
Machine -ability (chart 3)	Control	X	M/X
Abrasion Resist.	Control	M	O

O: similar to control, M: marginal(lower), X: poorer

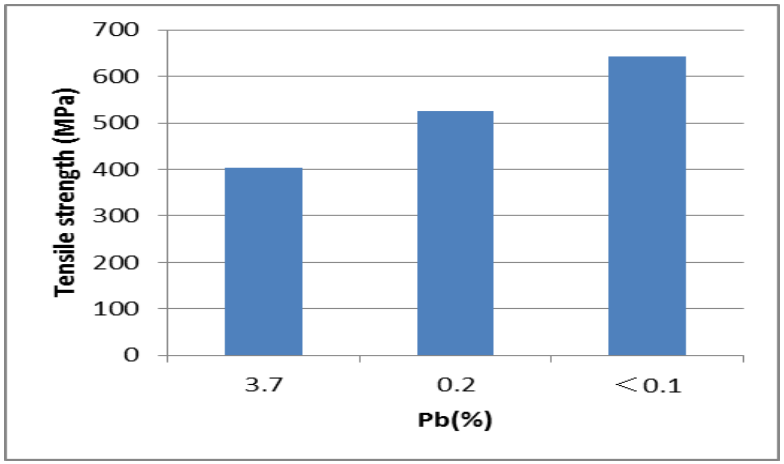
2. Test Result (Material Property)

Table 2 : Material Property

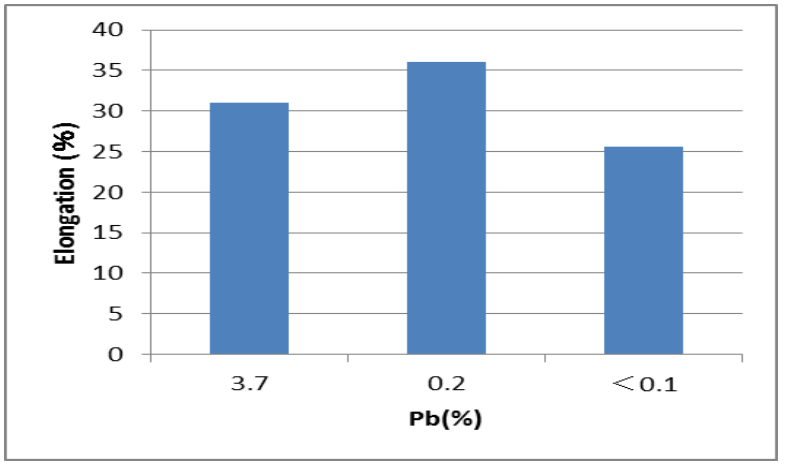
Pb (ave. %)	3.7	0.2	<0.1 (Si-type)
Tensile strength	Control	O	O
Elongation	Control	O	M
Conductivity	Control	O	X

O: similar to control, M: marginal(lower), X: poorer

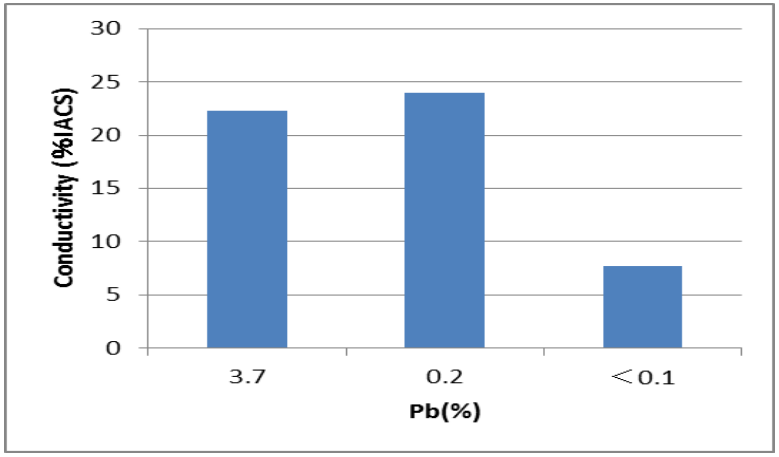
2. Test Result (Material Property)



Graph 2-1: Tensile strength



Graph 2-2: Elongation



Graph 2-3: Conductivity

- Lower lead content materials showed difference from the current 3.7%
  It may effect to component performance.
- For now, due to machinability concerning, proper samples with lower/free lead for component testing are not available yet.

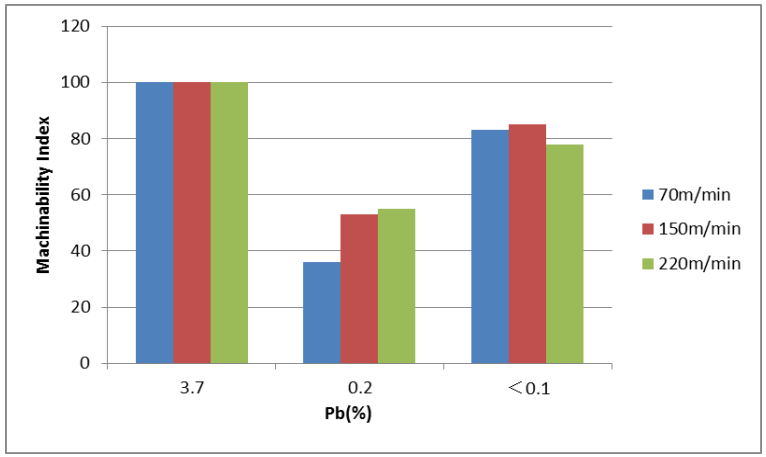
3. Test Result (Machinability)

Table 3 : Machinability

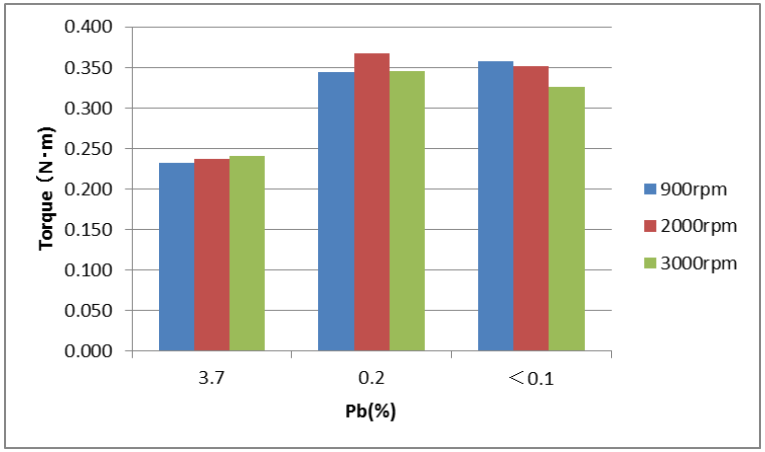
Pb (ave. %)	3.7	0.2	<0.1 (Si-type)
Cutting Force	Control	X	M
Drilling Force	Control	X	X
Drilling Time	Control	X	X

O: similar to control, M: marginal(lower), X: poorer

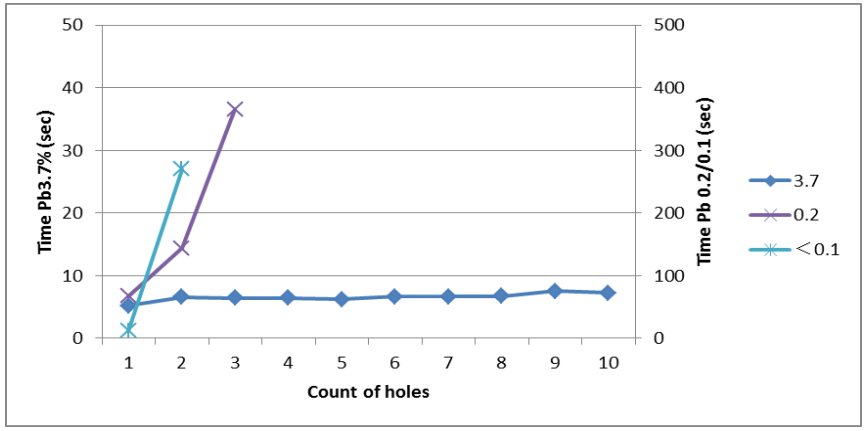
3. Test Result (Machinability)



Graph 3-1: Cutting force



Graph 3-2: Drilling force



Graph 3-3: Drilling time

- Due to testing difficulty, cutting time was limited (10 times). It is much fewer than manufacturing conditions.
- Only few times cutting, lower/free lead material showed lower/poorer machinability than current (3.7%) It may cause large difference on manufacturing conditions.