Current status and Future Plan for Niobium Production in Tokyo Denkai

Hiroaki Umezawa
Tokyo Denkai. Co., Ltd.

Contents

- History of Nb production in Tokyo Denkai.
- How to produce fine grain Nb?
- Electron Beam Melting Furnaces.
- Present production capability.
- Future production capability.
- Specification.

History of Nb production in Tokyo Denkai

History

- 1950 Tokyo Denkai has been established.
- 1962 1st EBMF(130kw) has been installed.
- 1968 Nb business has been lunched to oblige JAERI's request for neutron irradiation capsule material.
- 1973 2nd EBMF(200kw) has been installed.

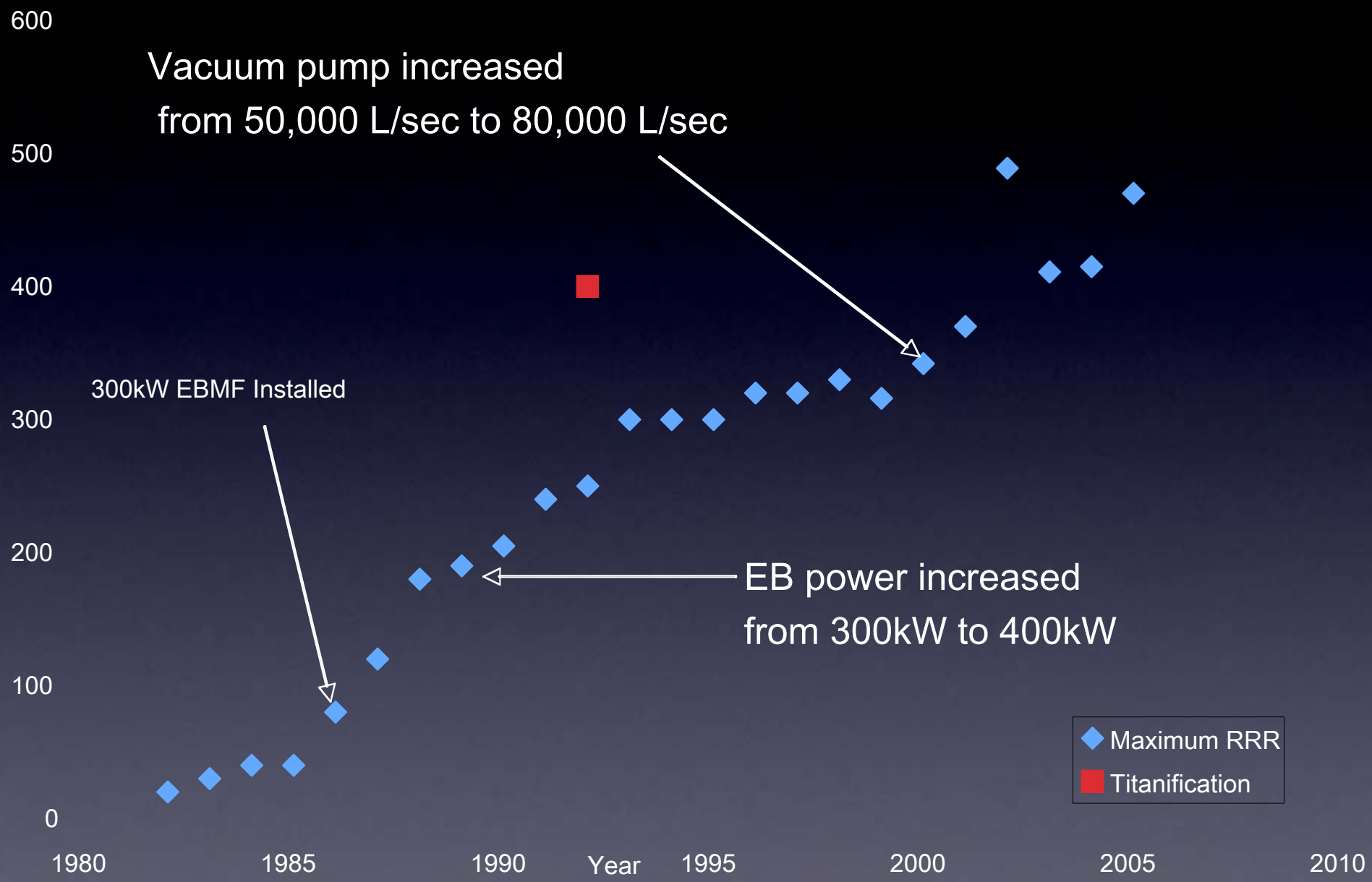
History

- 1985 High purity Nb development has been started under the guidance from KEK.
- 3rd EBMF(300kW→400kW) has been installed in 1986.
- The Niobium sheets have been adopted by KEK for TRISTAN MR SC Cavity in 1987.
- In house RRR measurement has been started in 1988.

History

- TD started to supply Nb sheets for TTF at DESY in 1996.
- 4th EBMF(600kW) has been installed in 1996.
- TD provided Niobium items as material of SC cavities of CESR, TLS and CLS in 2000.
- TD won a bid for 1/3 of SC Cavity material for SNS in 2000.
- 5th EBMF(1200kW) has been installed in 2003.

Progress in RRR



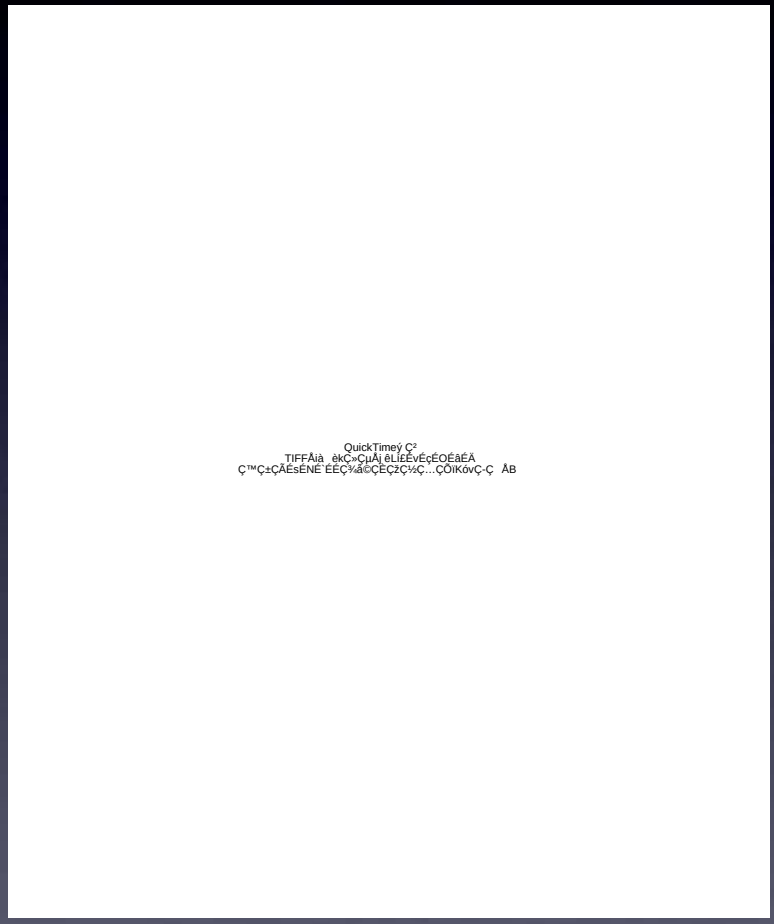
Equipment introduction plan

- 6th EBMF(600kW) is under installation.
- 7th EBMF(600kW) will be installed in early 2007.
- 8th EBMF(600kW) will be installed in 2007.

Electron Beam Melting Furnaces

EBMF No. 1

Gun Power 130kW
Installed in 1962
Made by Leybold HeraeusRetired in 1970’

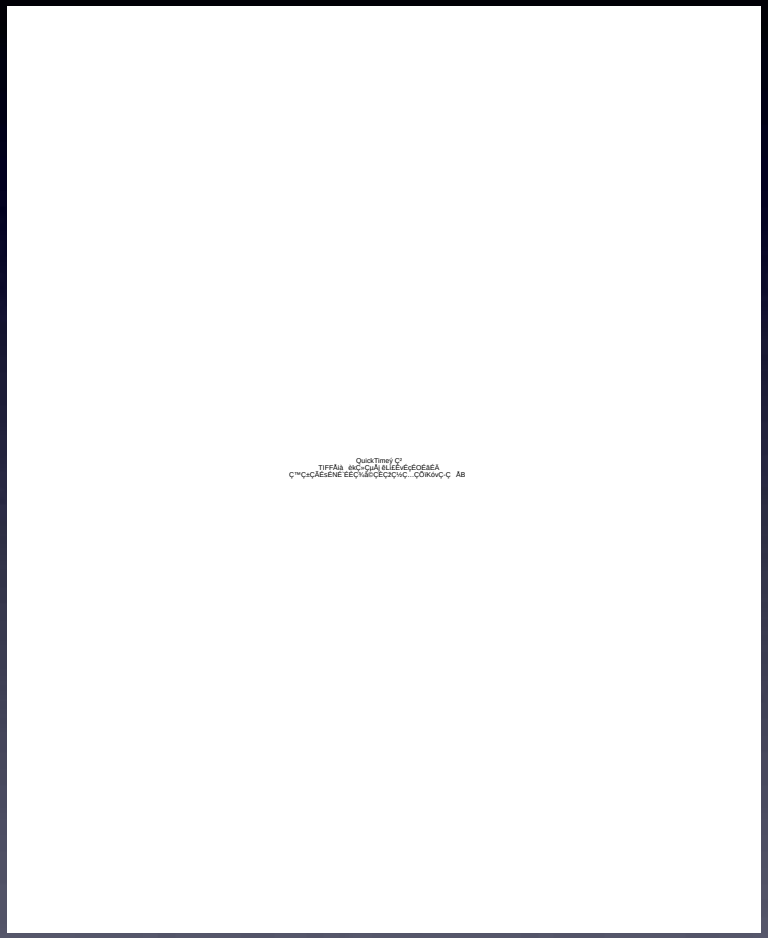


EBMF No. 2

Gun Power 200kW
Installed in 1973
Made by JEOL
Crucible Diameter
Ta: Max 110 mm,
Nb: Max 120 mm

EBMF No. 3

Gun Power 400kW
 Installed in 1986
 Made by Leybold Heraeus
Crucible Diameter
Ta: 140 mm (Max 160mm)
Nb: 230 mm (Max 250mm)

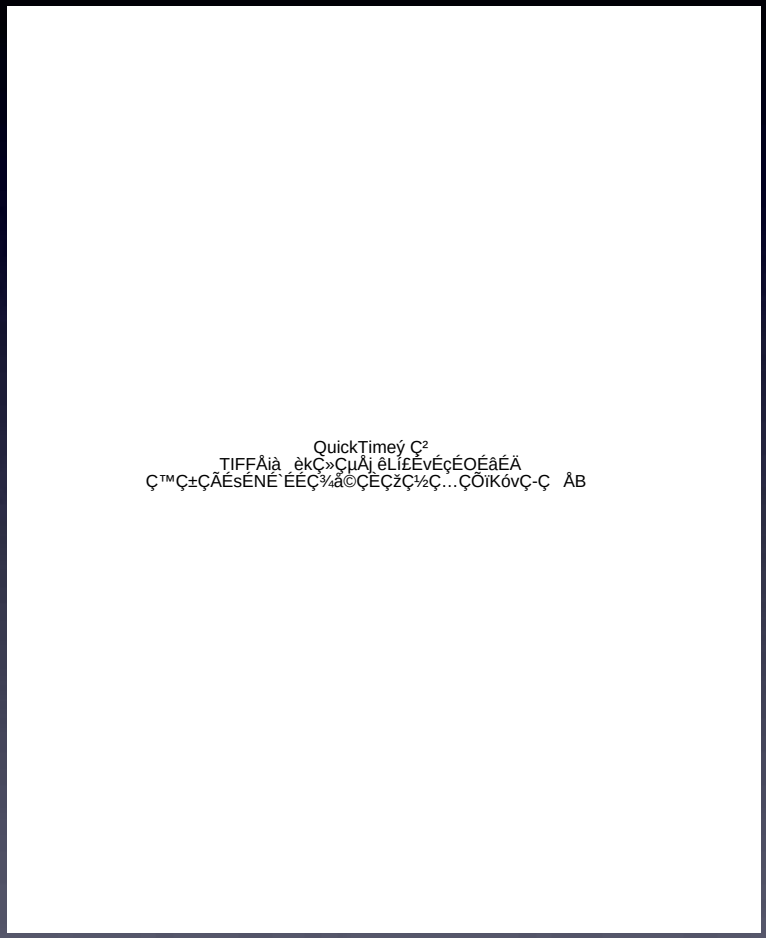


EBMF No. 4

Gun Power 600kW
Installed in 1996
Made by ALD Vacuum Technology GmbHCrucible
DiameterTa: 200 mm
Nb: 250 mm (Max 280mm)

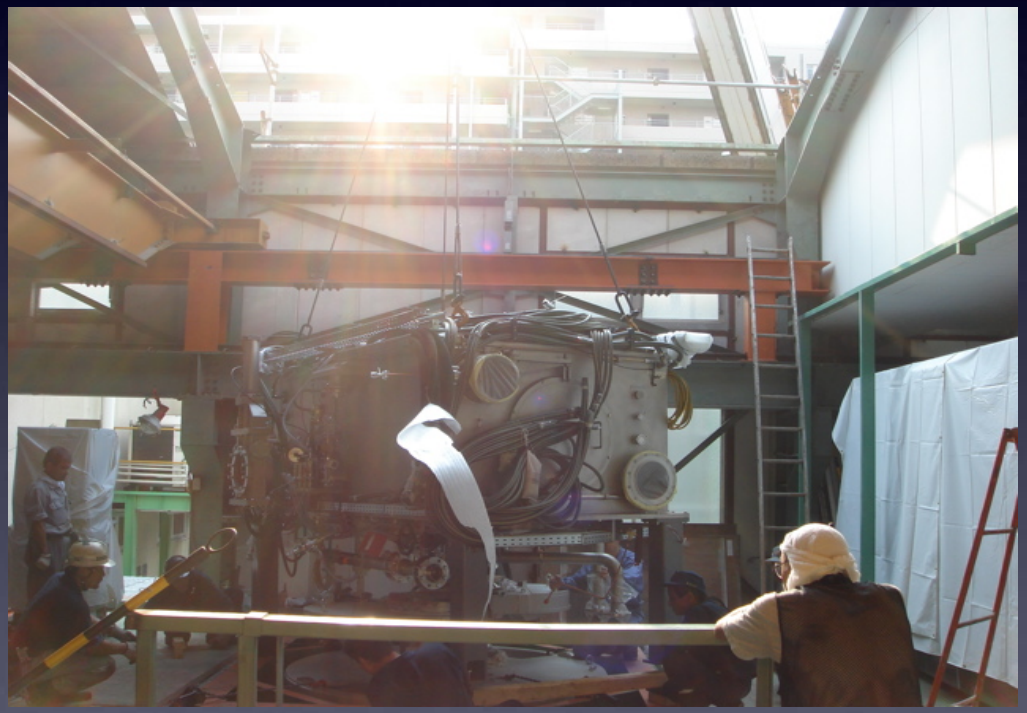
EBMF No. 5

Gun Power 1200kW
Installed in 2002 Made by ALD Vacuum Technology GmbHCrucible Diameter Ta: 200 mm

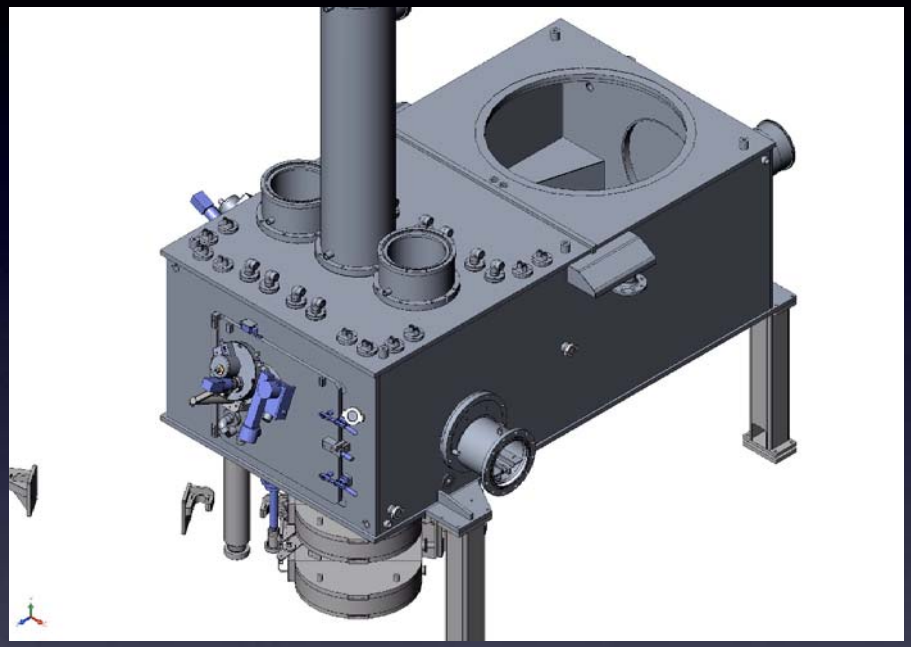


EBMF No. 6

Under installation.



EBMF No. 7 & No.8



Gun Power 600kW
Installed in 2007
Made by ALD Vacuum Technology GmbH
Crucible DiameterTa: 300 mm

EB Furnaces

Name	n of Gun	Gun Power	Crucible Size	Pumping Speed	Apprication	Installed
No.2	2	200KW	120 mm	36,000 l/sec	Nb, Ta, Nb based alloy,Test	1973
No.3	2	400KW	250 mm	80,000 l/sec	Nb	1986
No.4	2	600KW	300 mm	80,000 l/sec	Ta	1996
No.5	3	1800KW	500 mm	150,000 l/sec	Ta/Nb	2002
No.6	2	600KW	300 mm	50,000 l/sec	Ta	2006
No.7&8	2	600KW	300 mm	50,000 l/sec	Ta	2007

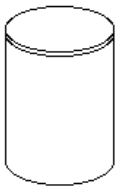
How to produce fine grain Nb?

How to produce fine grain Nb?

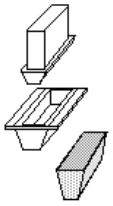
Fabrication process of Nb sheets for Superconducting Cavities

Tokyo Denkai Co., Ltd. H.Umezawa

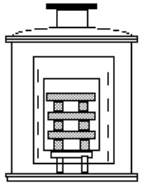
1. Mother Material



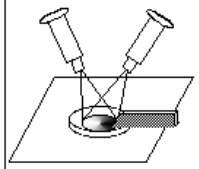
2. Pressing



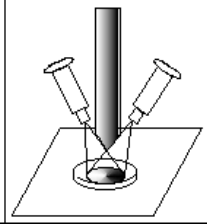
3. Out gassing and Sintering



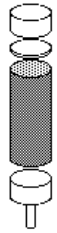
4. EB Melting(1st)



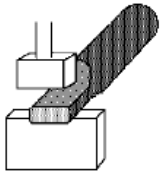
5. EB Melting (2nd, 3rd)



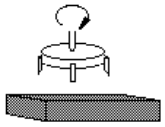
6. Cutting



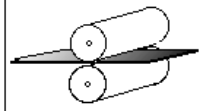
7. Forging



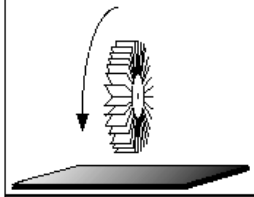
8. Mechanical grinding



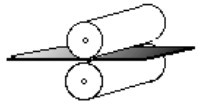
9. Rolling



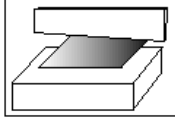
10. Polishing



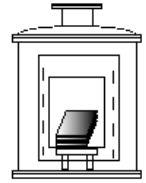
11. Rolling



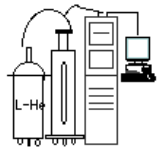
12. Cutting



13. Annealing

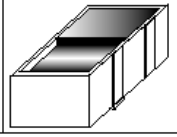


14. Testing



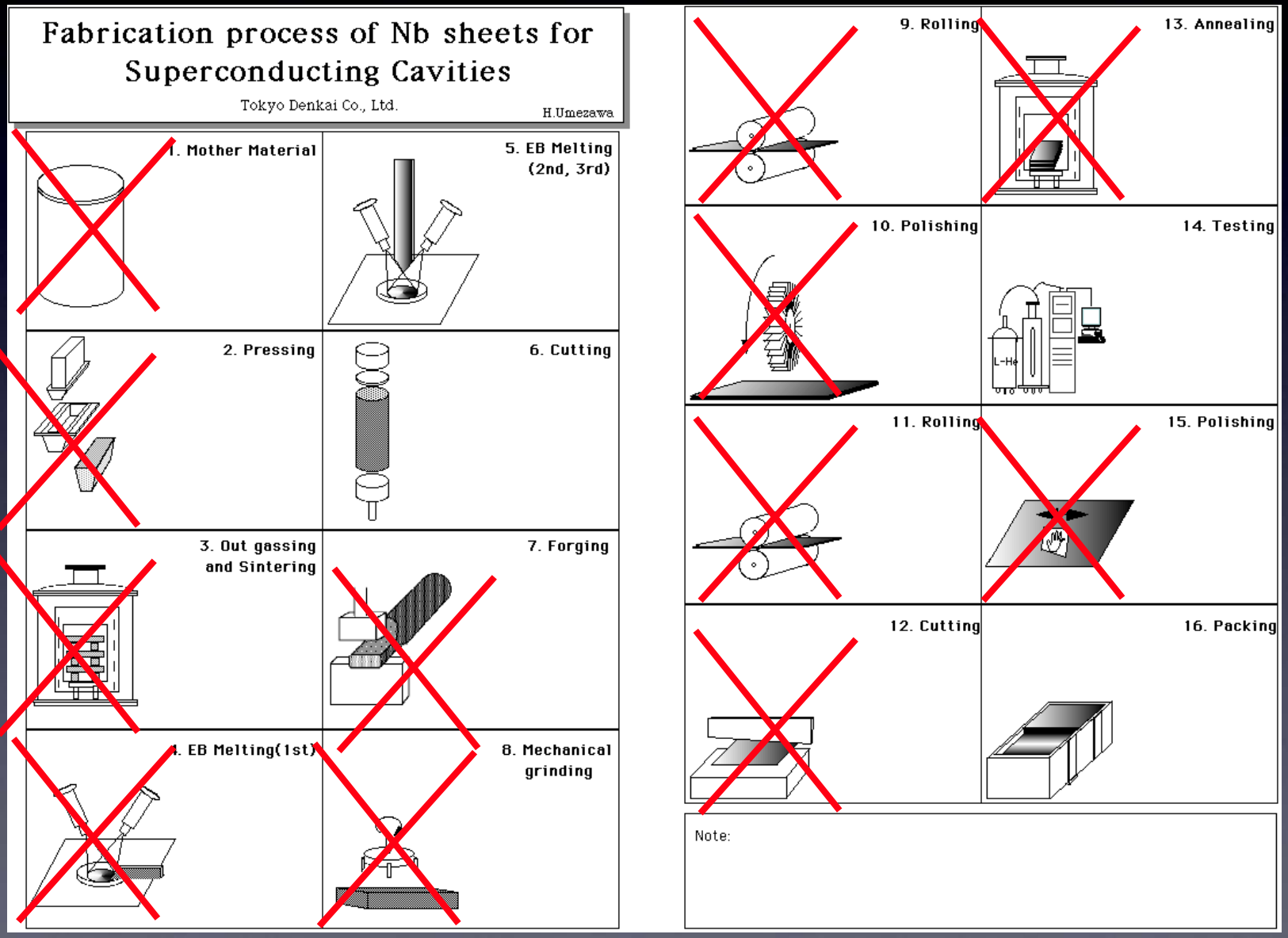
15. Polishing

16. Packing



Note:

If Single crystal...



Present production capability

Present production capability

- Melting Capacity: 10 ton/year
  - by No.3 EBMF
  - 4 Ingots x 6 times/month
  - 210kg / ingot, (225mmø x 620mm)
  - 840kg/month

Present production capability

- Sheet production Capacity: 20 ton/year
  - 24,000 sheets/year
  - 2.8mm x 265mm x 265mm RRR>300
  - 50 sheets/day
  - 2,000 sheets/month

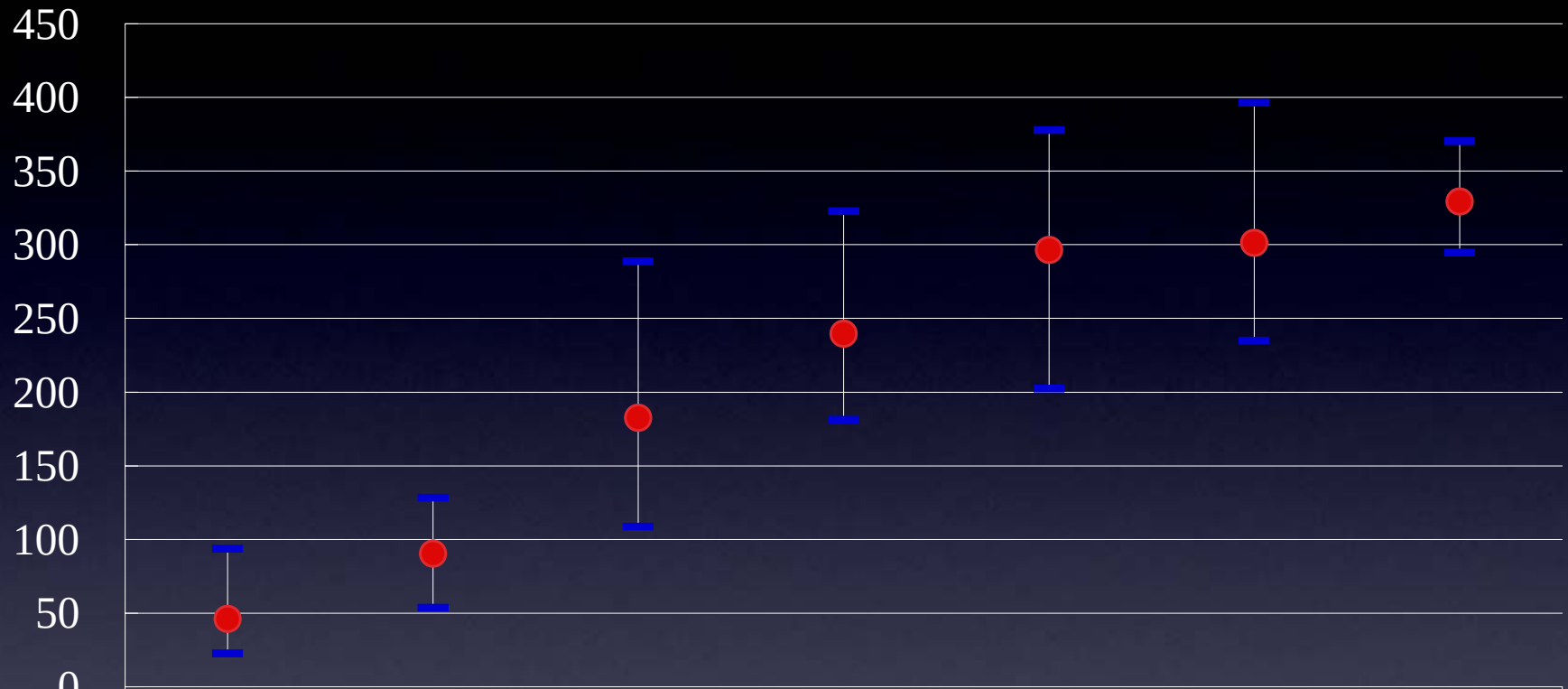
Future production capability

Future production capability

- Melting Capacity:
  - 20 ton/year (July 2007-)
  - 30 ton/year (December 2007-)
- by using of No.3 and No.5 EBMF

Specification

Change of RRR over melting times



	A/R	1	2	3	4	5	6
Max	93	128	289	323	378	396	370
Average	46	90	183	240	296	301	329
Min	23	54	109	181	202	235	295

Melting Times

Conclusion

- Present capability of niobium sheets production is 24,000 sheets(20 ton)/year.
- But, melting capacity is 10 ton/year (in case of RRR>300 ingot).

Conclusion

- July 2007, TD will convert a purpose of No.5 EBF from Ta to Nb.
- Niobium melting capability will increase to 20 ton/year. And capability of 30 ton/year will be expected in 2008.

Conclusion

- The relaxation of the RRR specifications is effective.