

New Production Process of Nb and Ta for Capacitors

Production of Nb for Capacitors by Preform Reduction Process

Production process of powder for capacitors

Comparison between Nb and Ta

	Niobium	Tantalum
Symbol of element	Nb	Ta
Atomic number	41	73
Atomic weight	92.9	180.9
Density	8.56 g/cm ³	16.65 g/cm ³
Melting point	2468	2980
Boiling point	4758	5534
Resistivity (20 °C)	12.5 μΩ·cm	12.4 μΩ·cm
Clarke number	2 × 10 ⁻³ (34 th)	1 × 10 ⁻³ (40 th)
World production	23000 ton	2300 ton
Demand in Japan	3900 ton	550 ton
Price(in round numbers)	55 \$/kg	700 \$/kg

Production volume of Nb is **10 times** that of Ta, price of Nb is **less than one-tenth** that of Ta.

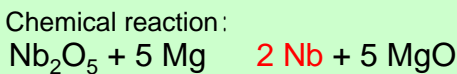
Nb powder is emerging as a substitute material of Ta for use in capacitor.



Uniform Nb powder with purity higher than 99.9% and particle size of 0.2 ~ 1.0 μm is required for capacitor application.

Preform Reduction Process (PRP)

Nb₂O₅ + Flux + Binder → Preform

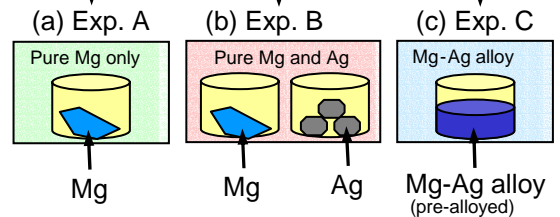
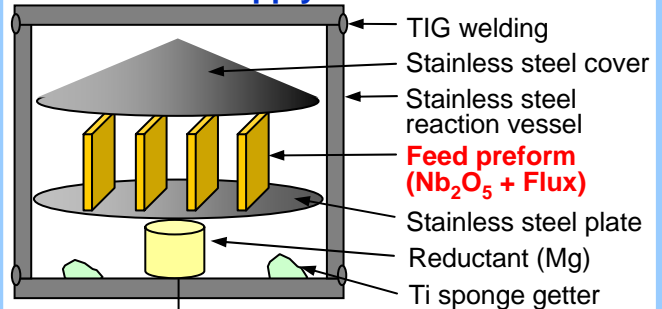


< Features >

- No emission of waste solution containing fluorine
- Flexible scalability, and homogeneous powder available
- Small amount of molten salts required
- (Semi-)Continuous and high-speed process

Experimental procedure and results

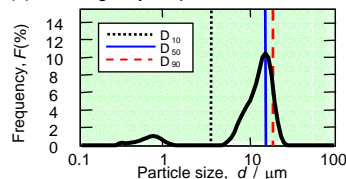
Reactor and supply method of reductant



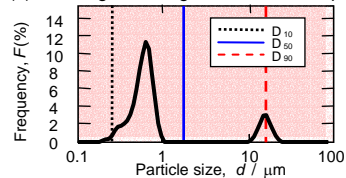
Particle size distribution and SEM image

$T_{red} = 1273 \text{ K}$, $t'_{red} = 24 \text{ h}$, Flux = CaCl₂, $X_{cat./Nb} = 0.2$

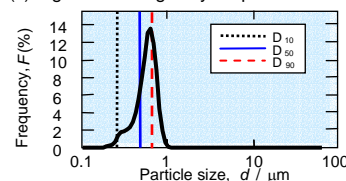
(a) Pure Mg only: Exp. A



(b) Pure Mg under Ag co-existence: Exp. B



(c) Mg-50mol% Ag alloy: Exp. C



99.7% purity

Highly pure and fine Nb powder was produced by controlling Mg vapor pressure using Mg-Ag alloy.

Resource Recovery and Materials Process Engineering Laboratory