KAWASAKI STEEL TECHNICAL REPORT
No.23 (October 1990)
R&D of High-Technology Research Laboratories,
Commemorating the 20th Anniversary
of the Technical Research Division

Preparation of Ultrafine Metallic Particles by Hydrogen Reduction of Chloride Vapors

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Synopsis :
Ultrafine particles of silver, copper and tungsten were prepared by the hydrogen reduction of chloride vapors, and the effects of reaction conditions on the shape, average size and size distribution of resultant particles were examined. Particle shape was spherical for silver and copper, and polyhedral for tungsten. Narrow log-normal distributions of particle size with geometric standard deviations between 1.2 and 1.4 were obtained regardless of the metals and their reaction conditions. Average particle diameters ranged from 20 to 1000 nm depending on the metals and their reaction conditions, and were controllable by selected chloride vapor concentration and reaction temperatures. Reaction conditions being equal, the particle size of silver was the largest, and that of tungsten was the smallest among the three. The ratio of the reaction temperature to the melting points is supposed to be an important factor in determining the size of ultrafine particles.

The body can be viewed from the next page.

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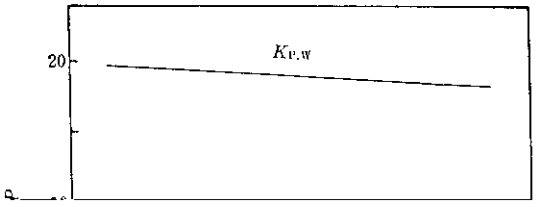
Synopsis:

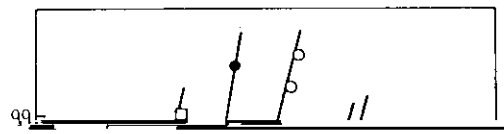
Ultrafine particles of silver, copper and tungsten were prepared by the hydrogen reduction of chloride vapors, and the effects of reaction conditions on the shape, aver-

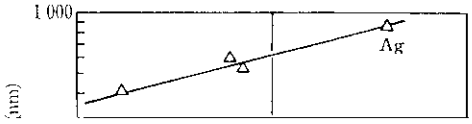
chlorides of those metals in the vapor phase. Recently Dugleux et al.[9] and Yoshizawa et al.[10] prepared UFPs of Fe, Co, Ni and their alloys under the same method and applied the UFPs to magnetic recording tapes. Morooka et al.[11] investigated the effect of reaction temperatures and partial pressures of metal chloride vapors

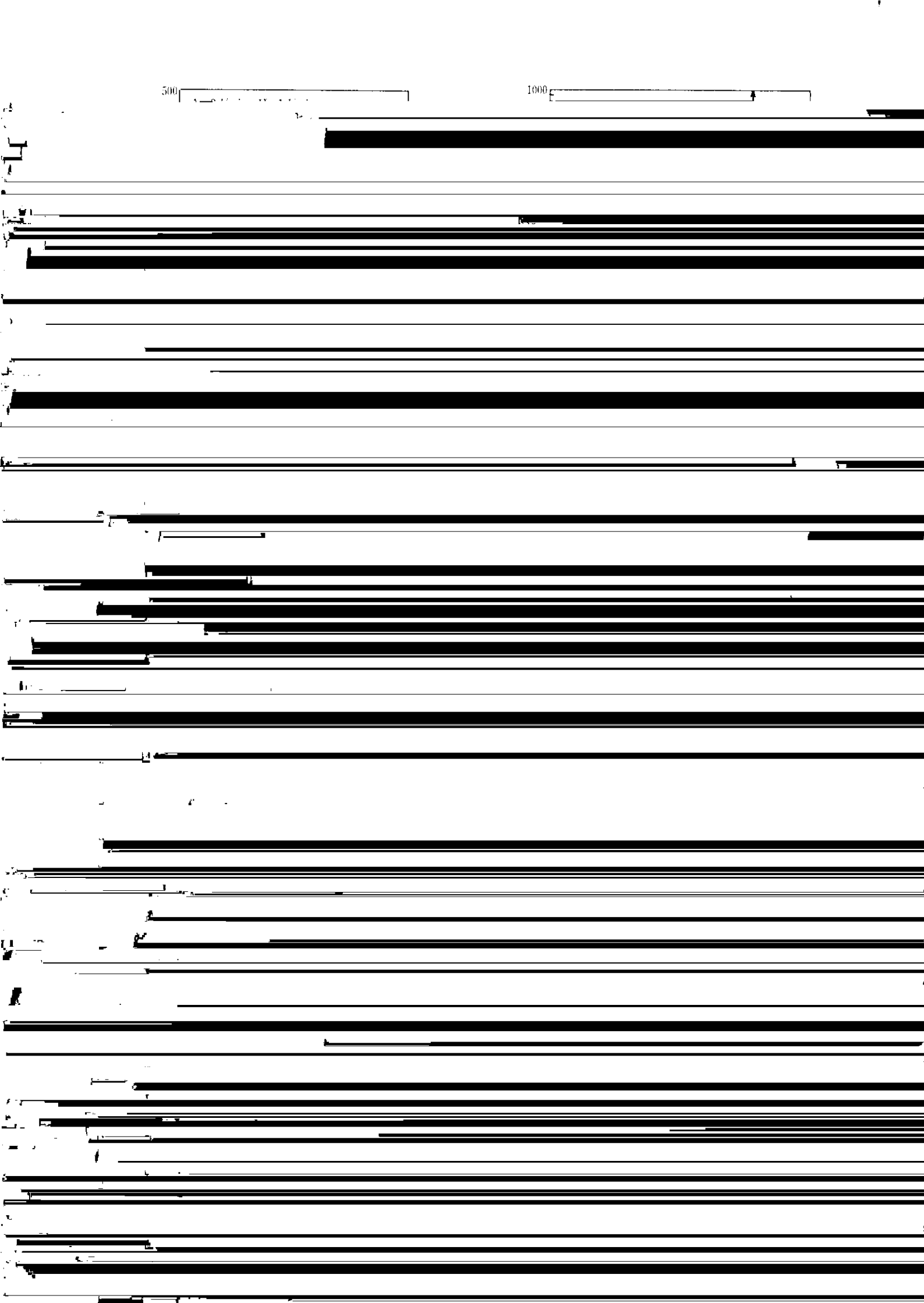


a given temperature, to start the reaction. The formation of smoke-like UFPs was observed in the glass tubes

Ag [redacted] Cu [redacted]




1 000
(nm)
Ag


500
1000

and D_S is the surface diffusion coefficient (cm^2/s), γ_0 the surface energy (erg/cm^2), N_0 the number of surface

among the three. A large ratio of reaction temperature to the melting point is favorable for promoting

temperature (K). Considering that D_S is expressed by