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Separation of gold nanoparticles using Micro Ultracentrifuge

CS-FNX Micro Ultracentrifuge and S140AT Fixed Angle Rotor

Metal cluster compounds contain hundreds of metallic nanoparticles which sizes are less than 2nm. Metal clusters have completely different physical properties from bulk states. Gold nanoparticles or silver nanoparticles have similar aspects. For example, bulk gold is not very reactive but gold cluster has catalytic property and applied to toilet deodorizer in practical use. For small gold nanoparticles, by the surface plasmon resonance provides a rich red color. Its typical application is the brilliant red color in stained glasses.

This paper reports about the separation of small gold nanoparticles using Micro Ultracentrifuge. The density of the gold nanoparticles is high, 19.3g/cm^3, the particle size is small, 1.8nm. We compared the separating conditions in three steps; 50,000×g, 100,000×g, and 1,050,000×g.

Contents

1. Sample

   Spherical Gold Nanoparticles（NANOPARTZ INC） Grain size：1.8nm

2. Conditions

   Centrifuge: CS150FNX Micro Ultracentrifuge

   Rotor: S140AT Fixed Angel Rotor* (10 tubes)

   Centrifuging tube: 1PC tube

   Rotating speed: 30,600rpm, 43,200rpm, 140,000rpm

   Maximum RCF: 50,000Xg, 100,000Xg, 1,050,000Xg

   Centrifugal time: 10 minutes

   Accel/Decel Mode: “9”/“7”

   Temperature: 4℃

   Centrifugal separation methods: Differential pelleting

* Note:You can run the S140AT rotor at its maximum speed when using a sample whose average density is less than1.7g/mL. To centrifuge a sample with an average density more than 1.7g/mL, reduce to the allowable speed by the following equation

$$\text{Allowable speed (rpm)} = \text{Maximum speed of the rotor (rpm)} \times \sqrt{\frac{1.7}{\text{Average density of sample (g/mL)}}}$$

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3. Results and discussion

Fig.1 shows the centrifugation results. Though the density of gold nanoparticles is high, 19.3g/cm^3, the particle size is small, 1.8nm, centrifugal force 50,000Xg or 100,000Xg is insufficient for the separation and the supernatant did not become transparent. And the pellet at the bottom of the tube was soft and brittle.

On the other hand, centrifugal force 1,050,000×g made the supernatant transparent and the pellets stuck to the tube wall, at the maximum radius of the rotor, and to the bottom of the tube. The pellet stuck to the tube wall was hard and firm. The pellet stuck to the tube bottom was soft and brittle. This leads the consideration that the both pellets gold nanoparticle size are different, the greater size pellet stuck to the tube wall and the smaller size pellet stuck to the tube bottom.

The results suggest that even the several nanometer size gold nanoparticles can be separated by high centrifugal force. Thus the applications to separation and refinement, purification of gold nanoparticles are expected.

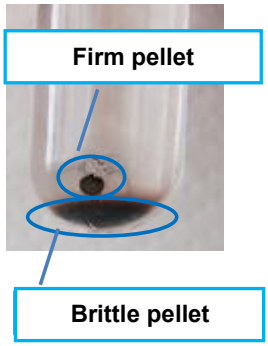
Before centrifugation	50,000 × g (30,600rpm)	100,000 × g (43,200rpm)	1,050,000 × g (140,000rpm)
			

Fig.1 Results of centrifugation

Instruments

CS150FNX
Micro Ultracentrifuge

or

CS150NX
Tabletop Micro Ultracentrifuge

S140AT
Fixed Angle Rotor

If you have any inquiry of this application or products, please contact us through our web site.
http://centrifuges.hitachi-koki.com/

Hitachi Koki Co., Ltd.
Life-Science Instruments Division

Shinagawa Intercity Tower A 2-15-1 Konan, Minato-ku Tokyo 108-6018 JAPAN
Tel :(81) 3-6738-0863, Fax:(81) 3-6738-0861

*The latest information is available on our web site: **http://centrifuges.hitachi-koki.com/**