

# Concentration Of Nanoparticles By Zone Heating Method

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## SUMMARY

UCLA researchers in the Department of Mechanical and Aerospace Engineering have invented a novel method to concentrate nanoparticles (NPs) into metal crystals via zone melting.

## BACKGROUND

Materials that contain high volume dispersed NPs can offer unusual mechanical, physical, and chemical properties for a variety of applications, including electronics, catalysis, energy, and lightweight materials for automobiles and aircraft. Normally, a low volume percentage of NPs (< 1-2 vol%) can be dispersed by most methods, such as ultrasonic, evaporation, or condensation. However, it is difficult to obtain a high-volume percentage ( $\geq 5$  vol%) NPs in solidified materials, such as metals. Zone refining/melting is a well-established technique for crystal purification, but has never been used to concentrate NPs in molten materials before they are solidified. Solids with a high-volume percentage of NPs can be used for countless applications, but improvements to their synthesis and scalability must first be further developed.

## INNOVATION

Researchers led by Professor Xiaochun Li have developed a novel method to improve the concentration of metal NPs ( $> 5$  vol%) into a solid material by utilizing zone directional melting. Moreover, multi-cycles can be used to achieve a higher concentration of NPs in the final solid. This innovative method is easy to setup, can be readily used for mass production, and will have widespread applications in solidification nanoprocessing.

## APPLICATIONS

- ▶ Composite nanomaterials
- ▶ Solidification nanoprocessing
- ▶ Lightweight, high performance nanocomposites
- ▶ Electronics, catalysis, and energy applications
- ▶ Lightweight materials for automobiles and aircraft

## ADVANTAGES

- ▶  $> 5$  vol% NPs
- ▶ Multi-cycles can be used to increase NP concentration
- ▶ Zone melting process
- ▶ Scalable and can be mass produced

## STATE OF DEVELOPMENT

Nanoparticle/metal solid materials have been successfully fabricated and their mechanical and physical properties have been tested.

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Evaporation-Based Method For Manufacturing And Recycling Of Metal Matrix Nanocomposites](#)
- ▶ [Super Ceramics With Self-Dispersed Nanoparticles Via Casting](#)

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## INVENTORS

- ▶ Li, Xiaochun

## OTHER INFORMATION

### KEYWORDS

Nanoparticles, NPs, zone melting, directional melting, mass production, electronics, catalysis, energy, lightweight materials, nanocomposite, nanoprocessing

### CATEGORIZED AS

- ▶ **Engineering**
  - ▶ Engineering
  - ▶ Other
- ▶ **Materials & Chemicals**
  - ▶ Composites
  - ▶ Nanomaterials
  - ▶ Other
  - ▶ Thin Films
- ▶ **Nanotechnology**
  - ▶ Electronics
  - ▶ Materials

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2016-523-0

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