Density gradient ultracentrifugation for colloidal nanostructures separation and investigation

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Density gradient ultracentrifugation (DGUC), as an effective method for the purification of nanomaterials, has attracted research. A recent review was reported by *Science Bulletin* in a paper titled "Density gradient ultracentrifugation for colloidal nanostructures separation and investigation," by Xiaoming Sun and Liang Luo et al from Beijing University of Chemical Technology. The authors systematically introduce the classification, mechanism and applications of density gradient ultracentrifugation (DGUC) with various separation examples, demonstrating the versatility of such an efficient separation technique.

Monodispersed nanoparticles and their assemblies have great application potential due to their unique optical, electrical, magnetic and catalytic properties. During the last two decades of rapid development of nanomaterials, researchers have made progress in synthetic methods of developing monodispersed nanoparticles for semiconductors, metals and oxides, and many single or multi-component assemblies have also been fabricated. However, the synthetic repeatability of monodispersed nanomaterials always remains a main limit of large-scale fabrications and applications. Further, rational design and synthesis of doped nanostructures with complicated components or complex structures such as core/shell structures or asymmetric structures have become new issues in chemistry and material science, mainly due to the uncertain repeatability. But the separation methods for nanomaterials remain far behind. Typical methods such as membrane filtration, electrophoresis

and magnetic fields, also have many restraints and limited separation effects, which hinder the practical applications of nanodevices in various fields.

Aiming to solve the above issues, the DGUC technique, which was used to sort macromolecules in biology, has recently been demonstrated as an efficient way of sorting colloidal nanoparticles by several research groups including those led by Hersam and Sun. The DGUC can realize the separation of nanoparticles according to their differences in chemistry, structure, size and/or morphology. The authors introduced the classification, mechanism, applicability and instructions of DGUC, and demonstrated the applications including separation, purification and ultra-concentration of nanoparticles by DGUC, verifying the versatility. They further developed a new "lab in a tube" method, which is helpful to monitor and get deeper insights into synthetic mechanisms, in situ surface reactions and assembly processes.

More information: Pengsong Li et al, Density gradient ultracentrifugation for colloidal nanostructures separation and investigation, *Science Bulletin* (2018). DOI: 10.1016/j.scib.2018.04.014

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