

## New Directions in Colloidal Metal Nanoparticle Synthesis

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This lecture will highlight recent advances in the synthesis of plasmonic nanoparticles, including novel methods for the synthesis of optically active plasmonic nanomaterials and in situ growth on arbitrary surfaces. Although much research has been reported on the use of colloid synthesis to control the size and shape of metal nanoparticles and their influence on plasmonic properties, a strong rejuvenation has recently come along the observation of plasmonic optical activity in chiral plasmonic nanoparticles [1,2]. In particular, it has been demonstrated that the well-known seeded-growth method can be employed to endow colloidal nanoparticles with chiral morphological features. Various approaches will be introduced, comprising either the use of chiral amino acids [3] or the self-organization of surfactant micelles into chiral structures on nanoparticle seeds [4]. These concepts open up a wide range of possibilities, by playing around with the variety of potential chiral co-surfactants, seed morphologies and metal compositions, which have been studied in the context of the seeded growth of metal nanoparticles [5]. On the other hand, recent progress has also expanded the knowledge and increased the degree of control over the morphologies of metal nanoparticles grown on solid and soft substrates [6,7]. A promising prospect goes in the direction of combining these methods to grow chiral nanostructures on arbitrary substrates.

### References

- [1] N.H. Cho et al., *Nat. Rev. Bioeng.* 2023, 1, 88.
- [2] G. Zheng et al., *Chem. Soc. Rev.* 2021, 50, 3738.
- [3] B. Ni et al., *Adv. Mater.* 2023, 35, 2208299.
- [4] G. González-Rubio et al., *Science* 2020, 368, 1472.
- [5] K. Van Gordon et al., *Angew. Chem. Int. Ed.* 2024, 63, e202403116.
- [6] G.A. Vinnacombe-Willson et al., *Chem. Rev.* 2023, 123, 8488.
- [7] G.A. Vinnacombe-Willson et al., *Chem. Mater.* 2024, 36, 5192.