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Design and realization of magneto-electric nanoplatelets

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The unique magnetic properties of ferrimagnetic barium hexaferrite, particularly its uniaxial magnetocrystalline and shape anisotropy, have enabled the development of the first ferromagnetic liquids [1]. However, despite the converse magnetoelectric (ME) effect arising from the coupling between the magnetic dipoles of barium hexaferrite nanoplatelets (BHF NPLs) and the liquid-crystalline director [1], BHF ferrofluids are responsive only to magnetic fields. Here, we introduce a new design of BHF NPLs that enables electrical sensitization through the creation of a coupled magnetic–electric dipolar particle [2]. Our approach is based on BHF NPLs whose magnetic moment is oriented perpendicular to the basal plane and which are selectively hybridized on only one basal plane with electrically polar ligands. When these ligands assemble with their electric dipoles oriented parallel or antiparallel to the magnetic dipole of the NPL (Figure 1), an ME NPL is formed. To realize this concept, we developed a surface-selective hybridization procedure at a solid–liquid interface by optimizing the key processing steps: magnetically directed monolayer assembly of BHF NPLs, the hybridization mechanism and conditions, and the harvesting of the resulting ME NPLs.

The coupled dipolar character of the dispersed ME NPLs was verified by our new method, multidipole electrophoresis in a magnetic field. These results provide a platform for the development of magnetoelectrically active liquids.

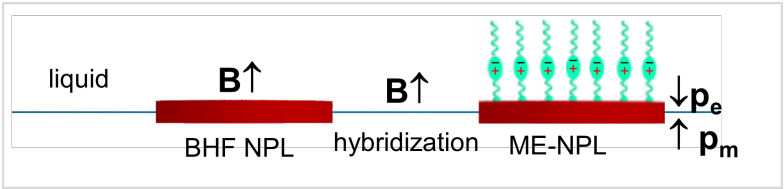

Figure 1:

References

[1] A. Mertelj, D. Lisjak, M. Drofenik, M. Čopič, *Nature*, 502 (2013), 237.

[2] A. Tufani et al., *ChemRxiv*, 19 March 2026. DOI: 10.26434/chemrxiv-2026-mf0tj/v2.

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