

SEMINAR I

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Development of an In-House Magnetic-Field-Assisted FDM Platform for Polymer-Bonded Magnetic Composites

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Magnetic-field-assisted printing provides a pathway for controlling the internal magnetic architecture of printed devices during fabrication. This research focuses on Fused Deposition Modeling (FDM) of polymer-bonded magnetic composites for motor and sensing applications. Improving magnetic particle alignment during printing is critical, as particle orientation, filler distribution, and magnetic anisotropy significantly influence remanence, coercivity, stray-field distribution, and overall device performance. Usually, Magnetic field assisted FDM (MAFDM) of magnetic composites is constrained by binder dilution, high filler-induced viscosity, filament brittleness, porosity, and limited control over particle orientation. To address these challenges, this work introduces an in-house MAFDM platform called iRAPTOR. The system features a novel print-head design incorporating electromagnets, water cooling, and a nozzle-mounted micro-Hall-effect probe for real-time local magnetic field monitoring. Furthermore, this study explores the use of recycled neodymium–iron–boron (NdFeB) feedstocks as a sustainable alternative for printed bonded magnets. Future advancements will require the development of stronger and more uniform field sources, high-filler printable feedstocks, adaptive process control, predictive modeling, and comprehensive device-level validation.

Kindly invited.