

# **Hydrophobic or Hydrophilic Micro Helices: Crafting Surfaces with Electrospun Magnetic Polystyrene Fiber and an Innovative Top-Down Technique**

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Abstract:

Micro helices are an important structure capable of overcoming low Reynolds number limitations and can be used in various microfluidic and biological applications. The fabrication of such micro helices is a challenge as existing fabrication techniques are restrictive in material choices and require sophisticated equipment. Here we demonstrate a simple top-down approach to fabricate micro helical structures using surface modification of helical electrospun fibers to produce both hydrophilic, silica coated (Si-HMPF) and hydrophobic, caramel sol-based (Ca-HMPF) magnetic micro helices post modification. The glassy coating obtained on the surface in both the cases facilitated obtaining magnetic micro helices via mechanical fracture of the fibers by grinding at room temperature. SEM images of the samples confirm the successful fabrication of micro helical structures which resembles the popular microswimmer morphology. The FTIR and VSM characterization were performed to study the functional groups present and the magnetic nature of the fabricated micro-helices. The thermal stability of the samples was investigated using DSC and TGA studies. Both hydrophilic and hydrophobic magnetic micro-helices were successfully fabricated through a simple sol-based coating technique and confirmed by wettability study.

Keywords: Micro helices, Helical magnetic microswimmer, Silica functionalization, Sugar glass coating.