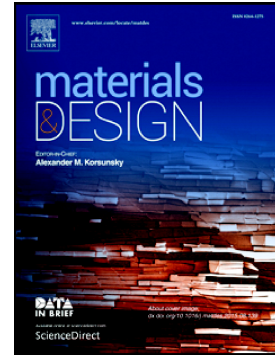


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# Biocompatible Magnetic Nanocomposite Microcapsules as Microfluidic One-way Diffusion Blocking Valves with Ultra-low Opening Pressure

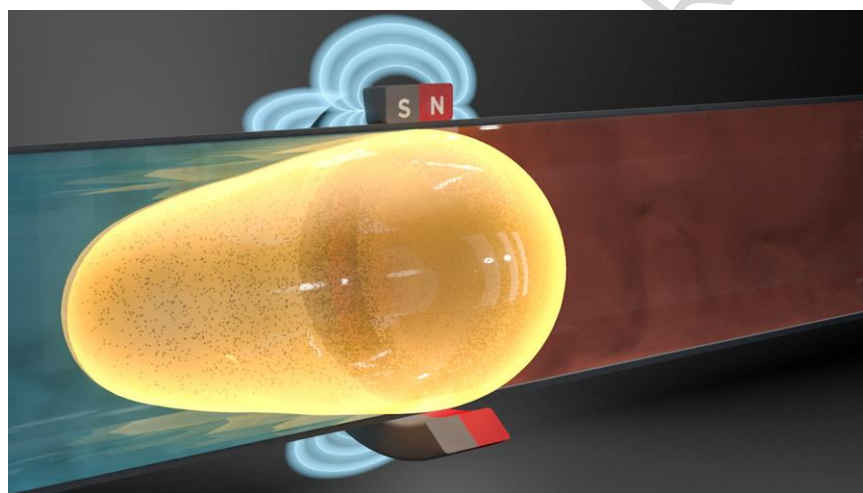
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## GRAPHIC ABSTRACT



## HIGHLIGHTS

- This paper introduces a one-of-a-kind biocompatible magnetic microcapsule as an in-line passive valve.
- The microvalve can achieve robust flow rectification for precise flow control and diffusion blocking for contamination prevention.
- The valve features an extremely low inlet flow opening pressure.
- The valve is highly scalable and customizable, enabling integration with a variety of microfluidic channels and systems.

## KEYWORDS

Valve, Microfluidics, Magnetic, Microcapsule, Diffusion barrier, Flow rectification

## ABSTRACT

A one-of-a-kind biocompatible magnetic nanocomposite microcapsule is developed as an in-line passive valve that can be integrated with micropumps and microfluidics. The magnetic nanocomposites act as the core for building a valve that utilizes the magnetic force attraction for sealing the microfluidic channels. The nanocomposites, molded with commercial microtubings, are prepared by incorporating  $\text{Fe}_3\text{O}_4$  nanoparticles into polyethylene-glycol (PEG). Parylene-C provides a flexible, biocompatible shell and

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