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Magnetically Driven Transport on Microlamellar Surfaces

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Multi-lamellar laser-inscribed structures on the surface of a magnetoactive elastomer enable controlled directional transport of objects under magnetic field actuation. When driven by a rotating magnetic field, the lamellae reorient sequentially, allowing this magnetoactive microlamellar structure to behave as a magnetic "conveyor belt". We analysed the transport of solid spheres on these magnetic conveyor belts by studying the dynamic response of lamellae to the magnetic field and quantifying the energy and momentum transfer of a single lamella to a solid sphere [1]. This energy transfer determines the upper limit of the transport speed of a solid sphere and further demonstrates three distinct transport regimes: kicking, pushing and bouncing. We showed that the transport regime is determined by the propagation velocity with which sequential lamellae reorient along the array, which is dictated by the angular velocity of the rotating magnetic field. Our results establish the physical mechanisms governing directional transport on magnetic microlamellar systems and provide a basis for the design and optimisation of magnetically actuated transport systems.

Acknowledgments

This research was funded by the Slovenian Research and Innovation Agency (ARIS, research programs no. P1-0192, P2-0231 and P2-0392), the European Union's Horizon Europe research and innovation programme under Marie Skłodowska-Curie Actions Doctoral Network MAESTRI (grant agreement no. 101119614), the Slovenian-German bilateral research project (ARIS-DAAD, BI-DE/25-27-003, Project-ID: 5773025), and within the framework of the GREENTECH project, cofinanced by the European Union – NextGenerationEU. The work of R.K. and M.S. in Regensburg was funded by the German Research Foundation (DFG, project no. 524921900). Views and opinions expressed are, however, those of the authors only and do not necessarily reflect those of the European Union or the European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

References

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Type:
Oral