Poster Presentation

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The RodBot approach to automated crystal harvesting

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Automated crystal harvesting is the main gap in the otherwise highly automated process of structure determination by X-ray crystallography. Many approaches have been presented, but few have proceeded beyond the initial, developmental stage. We recently introduced a rod-shaped microrobot1 (the "RodBot") to assist in the harvesting process. Driven by rotating magnetic fields to roll on a substrate, RodBots induce fluid flows that can lift crystals off the surface and trap them in a cylindrical vortex that travels with the RodBot. The gentle, fluidic force acting on the crystals is in the range of a few nanoNewtons to tens of nanoNewtons, and is spread over the whole surface of the crystal. Forces of this magnitude enable the RodBot to safely manipulate crystals ranging from a few microns to sub-millimeter size. With this technique individual crystals can be selected and brought to a loop positioned in the growth droplet to accept it. Harvesting and flash-cooling is then possible using a simple mechanical linkage. In this way the whole operation of crystal selection, harvesting and flash-cooling is remotely and gently carried out without the operator jitter or application of excessive strain that lead to high late-stage failure rates in crystal harvesting. Guidance is provided by the driving magnetic field, and can involve either manual input with a joystick or fully automated algorithms with feedback control. Because of this option of remote operation, RodBots can also be used for harvesting in hostile, sensitive or inconvenient environments such as anaerobic chambers, controlled humidity environments or cold rooms. The system is compatible with existing crystallization hardware and can be integrated readily into typical laboratory setups or high-throughput platforms.

[1] *H-W. Tung, K.E. Peyer, D.F. Sargent, B.J. Nelson, Appl. Phys. Lett., 2013, 193,114101.*

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