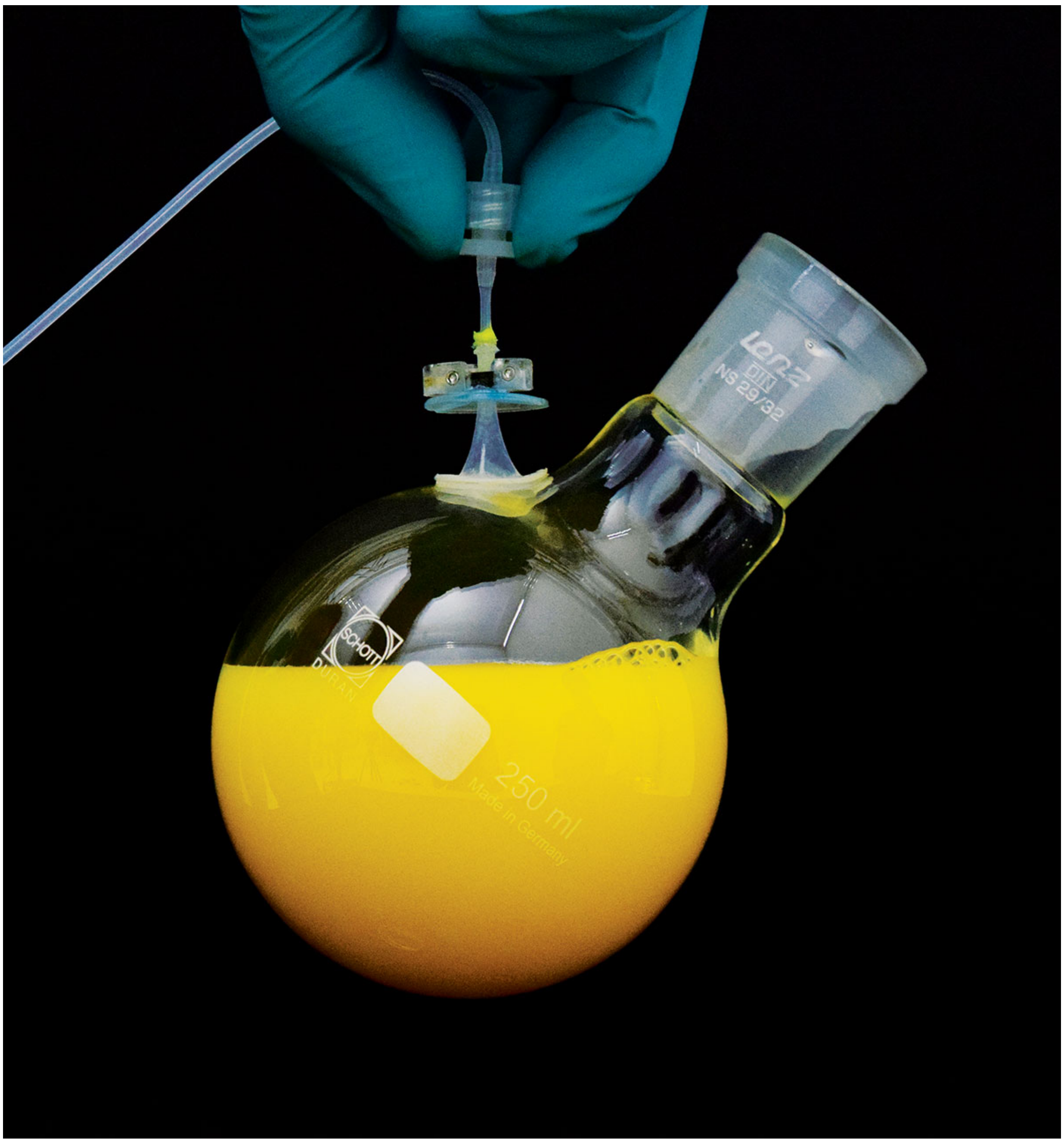
Flexible soft gripper mimics gecko to pick up objects with curved surfaces

May 16 2017, by Bob Yirka

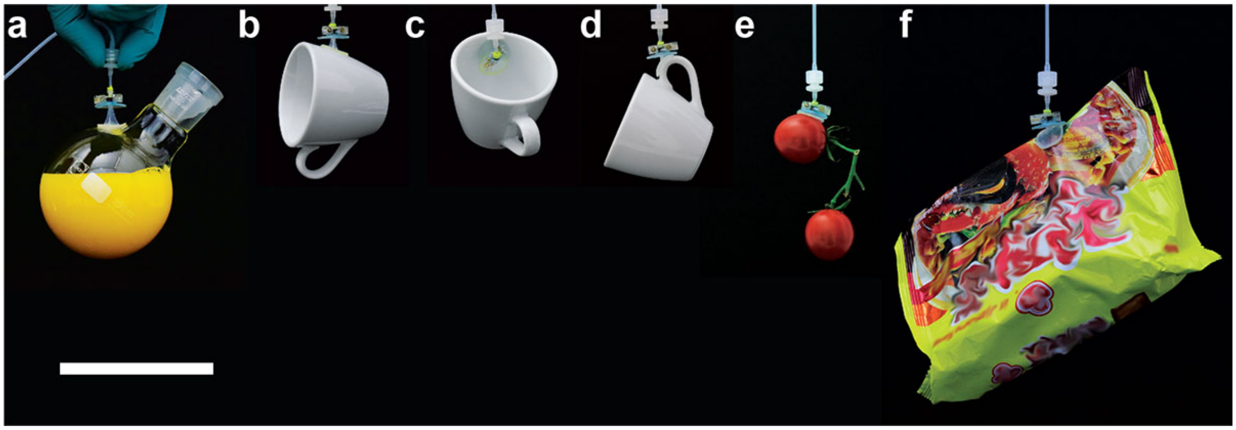


A soft adhesion-based gripping system supporting a rounded, liquid filled glass flask. Credit: Sukho Song

(Tech Xplore)—A small team of researchers with the Max Planck Institute for Intelligent Systems and Carnegie Mellon University has improved the design of robot grippers based on synthetic microfiber arrays—it allows for picking up objects with curved surfaces rather than just those with flat surfaces. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes their approach, the gripper they created and how well it works.

Scientists have long been fascinated by the way geckos are able to climb up walls with seemingly little effort. Study of the lizard showed that it was their application of Van der Waals forces that allowed them to achieve such feats. Over time, scientists have made progress in creating grippers that emulate the toes of the lizard using small platforms covered with arrays of synthetic microfibers that simulate the tiny hair-like structures on the gecko toe. But such grippers only work on flat surfaces because the backing platform must be rigid in order to exert pressure. In this new effort, the researchers report a new way to make the backing platform that overcomes this problem.

With the new gripper, instead of a rigid back, the researchers have used a soft flexible plastic cone. The narrow end is sealed by a tube passing through it that allows for air to be pumped in and out. The wide end is capped by a flexible platform covered with synthetic microfibers. To cause the gripper to grip, air is pumped out of the cone causing it to collapse and in so doing apply pressure against the flexible platform pushing it against the surface to be gripped. To release the gripper, air is pumped back in.



A soft adhesion-based gripping system supporting various 3D objects. Credit: Sukho Song

The researchers have tested their gripper by picking up a wide variety of everyday objects such as a coffee cup, a cherry tomato and even a plastic bag filled with candy—they found it capable of picking up objects weighing up to 300 grams. They report that their gripper works as conceived and that it outperforms other gripping systems. They suggest also that it could be easily scaled by using multiple grippers to pick up heavier objects, though they note testing still needs to be done to determine if the materials they used are durable enough to stand up to real world conditions.

More information: Sukho Song et al. Controllable load sharing for soft adhesive interfaces on three-dimensional surfaces, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1620344114

Abstract
For adhering to three-dimensional (3D) surfaces or objects, current adhesion systems are limited by a fundamental trade-off between 3D surface conformability and high adhesion strength. This limitation arises from the need for a soft, mechanically compliant interface, which enables conformability to nonflat and irregularly shaped surfaces but significantly reduces the interfacial fracture strength. In this work, we overcome this trade-off with an adhesion-based soft-gripping system that exhibits enhanced fracture strength without sacrificing conformability to nonplanar 3D surfaces. Composed of a gecko-inspired elastomeric microfibrillar adhesive membrane supported by a pressure-controlled deformable gripper body, the proposed soft-gripping system controls the bonding strength by changing its internal pressure and exploiting the mechanics of interfacial equal load sharing. The soft adhesion system can use up to ~26% of the maximum adhesion of the fibrillar membrane, which is 14× higher than the adhering membrane without load sharing. Our proposed load-sharing method suggests a paradigm for soft adhesion-based gripping and transfer-printing systems that achieves area scaling similar to that of a natural gecko footpad.

Citation: Flexible soft gripper mimics gecko to pick up objects with curved surfaces (2017, May 16) retrieved 19 April 2024 from https://techxplore.com/news/2017-05-flexible-soft-gripper-mimics-gecko.html