Scientists levitate wood on structured surfaces captured by high speed photography

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Scientists from the University of Minnesota have discovered a new behavior of woody biomass that makes it levitate above heated surfaces. Announced in *Nature Scientific Reports*, the research captures via high speed photography a particle of cellulosic biomass floating above a surface by aggressive generation of gases. The surprising new property can enhance biofuel production and has implications for cooking, tobacco use and forest fire suppression.

Development of the next generation of biofuels within thermochemical (non-biological) reactors aims to rapidly heat and convert woody biomass to liquids, which can be refined to gasoline, diesel or jet fuel. New reactors utilize fast heating by direct contact between biomass such as wood chips with nanostructured surfaces at high temperature (above 900 °F). "The problem was that nobody knew how biomass particles would behave on really hot surfaces," says Professor Paul J. Dauenhauer, DuPont Young Professor of the University of Minnesota.

"It turns out that wood behaves just like water at high temperature," says Professor Dauenhauer. When the team heated a particle of cellulose on a ceramic surface, it rapidly liquefied, lifted up, and floated away in a fraction of a second. Gases produced from reacting wood blew off the particle providing the source of lift and locomotion. Further research was able to show that the particle could be controlled by adjusting the surface structure. "We can design surfaces that control the levitation of wood; holes in the surface can improve or limit the extent of particle liftoff," says Dauenhauer.

Levitating wood turns out to be important for a number of energy applications. Rapid heating of wood, grasses and agricultural waste is critical to new biofuel reactors, but it also has an important role in everyday activities like cooking or tobacco use. "Any solid carbohydrate such as bread (for toast) or hamburger buns on the grill will levitate if heated enough," says Dauenhauer, "and that can slow the cooking speed by as much as a factor of ten."

This research is a part of a larger effort by the Catalysis Center for Energy Innovation to create breakthrough technologies for the production of biofuels and chemicals from lignocellulosic biomass. The center is funded by the U.S. Department of Energy as part of the Energy Frontiers Research Center (EFRC) program which combines more than 20 faculty members with complementary research skills to collaborate on solving the world's most pressing energy challenges.

More information: "Reactive Liftoff of Crystalline Cellulose Particles," *Scientific Reports* 2015, 5, 11238. DOI: 10.1038/srep11238

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