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Controlling material reactivity using architecture KYLE SULLIVAN, CHENG ZHU, ERIC DUOSS, MATT DURBAN, ALEX GASH, ALEXANDRA GOLOBIC, MICHAEL GRAPES, JOSHUA KUNTZ, CHRISTOPHER SPADACCINI, Lawrence Livermore Natl Lab, DAVID KOLESKY, JENNIFER LEWIS, Harvard University, LLNL TEAM, HARVARD UNIVERSITY TEAM —
Thermites are mixtures of a metal fuel with a metal oxide as the oxidizer. The reactivity of such materials can be tailored through careful selection of a variety of parameters, and can range from very slow burns to rapid deflagrations when using nanoparticles. However, in some cases diminishing returns have been observed as the particle size is reduced. 3D printing is a rapidly emerging field, which offers the capability of printing architected parts; for example parts with controlled internal feature sizes and geometries. In this work, we investigated whether such features could be utilized to gain additional control of the reactivity. This talk introduces several new methods for preparing thermite samples with controlled architectures using direct 3D printing, deposition, and/or casting. Additionally, we demonstrate that 3D printing can be used to tailor the convective and/or advective energy transport during a deflagration, thus enhancing or retarding the reaction. The results are promising in that they give researchers additional ways to control the energy release rate, without defaulting to the classic approach of changing the formulation.
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Kyle Sullivan
Lawrence Livermore Natl Lab

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