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In-Situ Imaging of Particles during Rapid Thermite Deflagrations[1] MICHAEL GRAPES, ROBERT REEVES, JOHN DENSMORE, Lawrence Livermore National Laboratory, KAMEL FEZZAA, Argonne National Laboratory, TONY VAN BUUREN, TREVOR WILLEY, KYLE SULLIVAN, Lawrence Livermore National Laboratory
— The dynamic behavior of rapidly deflagrating thermites is a highly complex process involving rapid decomposition, melting, and outgassing of intermediate and/or product gases. Few experimental techniques are capable of probing these phenomena in situ due to the small length and time scales associated with the reaction. Here we use a recently developed extended burn tube test, where we initiate a small pile of thermite on the closed end of a clear acrylic tube. The length of the tube is sufficient to fully contain the reaction as it proceeds and flows entrained particles down the tube. This experiment was brought to the Advanced Photon Source, and the particle formation was X-ray imaged at various positions down the tube. Several formulations, as well as formulation parameters were varied to investigate the size and morphology of the particles, as well as to look for dynamic behavior attributed to the reaction. In all cases, we see evidence of particle coalescence and condensed-phase interfacial reactions. The results improve our understanding of the procession of reactants to products in these systems.

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