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On explosive boiling of a Leidenfrost multicomponent drop[1] SIJIA LYU, Tsinghua University, HUANSHU TAN, University of California, YUKI WAKATA, XIANJUN YANG, Tsinghua University, CHUNG K. LAW, Princeton University, DETLEF LOHSE, University of Twente, CHAO SUN, Tsinghua University — A self-induced explosion of the droplet can produce a multitude of smaller secondary droplets which promotes fuel atomization. Here, we study a unique explosive gasification process of a tri-component droplet consisting of water, ethanol, and oil (ouzo), by high-speed monitoring the entire gasification event taking place in the well-controlled, levitated Leidenfrost droplet state over a superheated plate. It is observed that the preferential evaporation of the most volatile component, ethanol, triggers nucleation of the oil microdroplets in the remaining drop, which consequently becomes an opaque oil micro-emulsion. The oil micro-droplets subsequently coalesce to a large one that, in turn, wraps around the remnant water. Because of the encapsulating oil layer, the droplet can no longer produce enough vapor for its levitation, and thus falls and contacts the superheated surface. The direct thermal contact leads to vapor bubble formation inside the drop and consequently drop explosion in the final stage. Our comprehensive understanding of the entire boiling process of multicomponent drops provides the premise for designs in combustion applications and other industrial settings.

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