Early Stage Melt Ejection in Laser Percussion Drilling

Tom Eppes¹

¹University of Hartford, Hartford, CT, USA

Abstract

Laser percussion drilling is widely used in the aerospace industry to produce cooling holes in jet engine components. This process is a thermal, contact-free process which involves firing a sequence of focused optical pulses onto a target material. During each optical pulse, the central portion of the target area heats to a liquid then vapor state where the expanding gas produces a recoil pressure that forces the liquid material to move outward and upward in a conical fashion. This paper presents a 2-D, time-dependent analysis of laser percussion drilling that focuses on the early stage of melt formation and ejection using a non-isothermal laminar flow model using COMSOL Multiphysics® 4.3.

Reference

Figures used in the abstract

**Figure 1:** Velocity field (m/s) in the air region at t=2ms.

**Figure 2:** Velocity (m/s) versus time along x-axis 0.01mm below the target surface.
Figure 3: Velocity (m/s) versus time along y-axis 0.01mm below the target surface.

Figure 4: Particle flow history to 3.2ms at 0.5mm below the target surface.