

MULTI-LAYER SOLID LUBRICANT ARCHITECTURE FOR HAMMER DRILL COMPONENTS

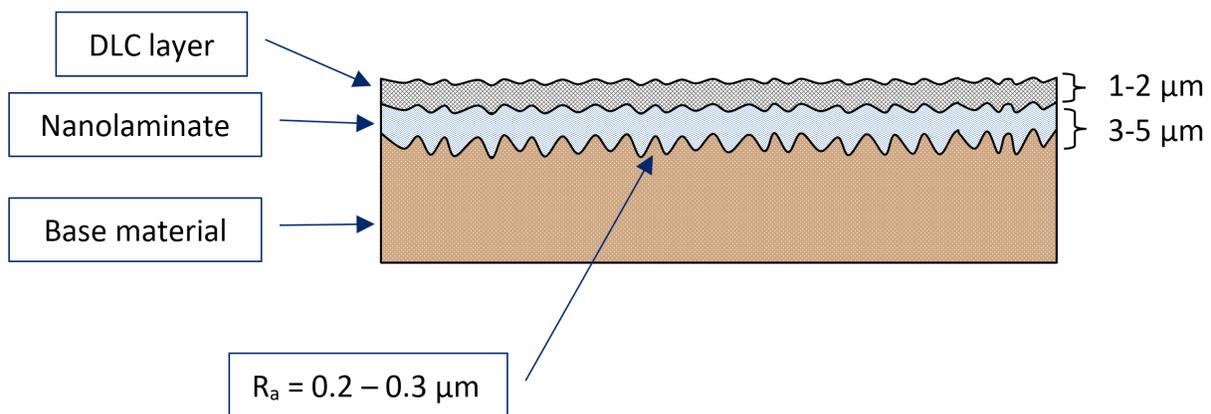
US Pat. No.: Patent Pending

Technology Readiness Level: 6-7

Representative of the Deliverable Demonstrated in Relevant Environment(s)

Researchers at Sandia National Laboratories have developed a coating architecture to replace conventional fluid lubricants with a multi-layer solid lubricant for use in drilling components deployed in extreme conditions. Down-the-hole (DTH) hammer drilling, used in mining, construction, and water well drilling, is arguably the most reliable and successful method for hard rock drilling. While conventional fluid lubricants are used for most DTH hammer drills, they are not ideal for certain circumstances, such as high temperature conditions or environmentally sensitive areas.

The multi-layer lubricant architecture developed by Sandia consists of three layers: a solid lubricant top layer (i.e. diamond-like carbon), a nanolaminate intermediate layer, and the base material. The lubricous layer is applied at a low surface roughness to reduce asperity contact stress and to increase integrity of the coating. The second layer serves three purposes: as an adhesion layer between the solid lubricant coating and the substrate, as a tough load bearing support structure to withstand impact loading conditions the hammer components might encounter during drilling, and as a diffusion barrier between the substrate and solid lubricant. The final layer is the base, which is preferably a high-strength, high-speed tool steel. In simulated high-temperature oxidizing environments, our multi-layer lubricant architecture proved to be a viable replacement to conventional lubricants (i.e. oil and grease) for surviving high temperatures without adversely affecting environments. To date, the coating has been tested in percussive hammers at temperatures up to 300°C.



TECHNICAL BENEFITS

- Decrease wear of moving parts
- Enables drilling at higher temperatures and in environmentally sensitive areas
- Increased adhesive wear resistance and adhesion to substrate
- High corrosion resistance

INDUSTRIES & APPLICATIONS

- Down-the-hole (DTH) drilling: mining, construction, and water well drilling