these positive laboratory tests, full-scale field tests were performed at the Combined Sewer Overflow Tunnel Project in Atlanta, Georgia. The coated cutters maintained their sharpness at least 20 percent longer than the uncoated cutters, resulting in less down time for disc replacement, higher penetration rates, and lower energy consumption. While the NanoSHIELD coating was first designed to prolong the life of cutting discs used for tunnel boring, it can also be used in other applications such as rock-mixing paddles, machining tools, and geothermal drilling tools.

A Choice of Fabrication Methods

To apply the NanoSHIELD coating, the team uses a method that involves depositing SAM (structurally amorphous material) powder by aspiration onto a disc cutter with a polymer-based binder. The binder retains the powder in place until laser fusing. A sufficient coating thickness for improving the wear resistance of a cutting disc is only 0.1 to 0.7 millimeters. Another method involves fusing the NanoSHIELD coating to a steel substrate using a direct metal deposition free-form laser and robotic system. Binders are not applied; rather, the powder is delivered by argon gas to an area where it is fused by the laser and solidified in place. The sophisticated software controlling the laser and robot allows the system to coat more complex geometries.

Performing Field and Laboratory Experiments

According to the Colorado School of Mines, in over 25 years of testing and research and development on coated disc cutters, NanoSHIELD-coated discs are the first to not spall or fracture after one linear cut of granite on a linear cutting machine used for simulating field conditions. The coating showed no signs of spalling even after more than 100 cuts on granite. Following these positive laboratory tests, full-scale field tests were performed at the Combined Sewer Overflow Tunnel Project in Atlanta, Georgia. The coated cutters maintained their sharpness at least 20 percent longer than the uncoated cutters, resulting in less down time for disc replacement, higher penetration rates, and lower energy consumption. While the NanoSHIELD coating was first designed to prolong the life of cutting discs used for tunnel boring, it can also be used in other applications such as rock-mixing paddles, machining tools, and geothermal drilling tools.

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