Production of super-hard cutting teeth on linear edge saw blades using Laser Directed Energy Deposition

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Metal Additive Manufacturing (AM) has found success in small scale batch production in recent years, particularly in the aerospace and medical sectors. More applications, new materials and process improvements have also been reported in various industrial sectors within the AM communities. There is, however, little development in continuous serial production using metal AM technologies. Over the past 5 years, C4 Carbides have been collaborating with the University of Hertfordshire to investigate laser-based Directed Energy Deposition to form super-hard cutting teeth using tungsten carbide (WC) powder on saw blades. To-date, the project has been successful in rapidly laying down the hardmetal coatings on the cutting tip. For high performance cutting blades, traditionally a tungsten carbide tooth (TCT) blade uses less than 1% of the starting quantity of the high value wear material, while the rest is machined off during the manufacturing process or left on the substrate and discarded when the sharp edges are worn. The project has shown the capability to deposit the minimum amount of WC exactly where needed saving over 70% of the expensive strategic materials, such as tungsten and cobalt, compared to commercial TCT saw blades. Using commercially available sintered WC powders, improved cutting performance has been achieved that has exceeded commercial bi-metal and high carbon steel saw blades. However, fusing sintered WC powder onto steel can result in brittle phase formation, leading to lower fracture toughness of the cutting edge. To overcome the limitation, a bespoke powder composition has been developed to deliver high hardness and high toughness coating, specifically tailored to overcome dynamic impact loading in cutting applications.