

Project Aim:

The project aims to investigate the wear and erosion mechanisms of difficult-to-cut materials using high-pressure abrasive waterjet (AWJ) cutting methods. The objective is to better understand how various machining parameters, such as waterjet pressure, feed rate, nozzle stand-off distance, and abrasive type, influence material wear and microstructural changes in these challenging metal alloys.

Research Description:

The project will involve a series of experiments to determine how waterjet pressure, type of abrasive particles, feed rate, and nozzle stand-off distance affect surface quality and material wear. Prepared titanium alloy samples will be processed using the Abrasive Waterjet Milling (AWJM) method, which involves milling with a water-abrasive jet to create structures such as grooves and pockets. Advanced microscopic techniques, such as Scanning Electron Microscopy (SEM) and Electron Backscatter Diffraction (EBSD), will be used to examine the microstructure of the machined surfaces and their changes compared to the pre-machined state.

Reasons for Research Topic:

AWJ is widely used in various industries due to its precision and efficiency. However, there is still a lack of comprehensive understanding of the erosion and wear mechanisms in materials processed by abrasive waterjet cutting. Understanding these processes is crucial for optimizing surface quality, improving machining practices, and extending the lifespan of machined components. My research will fill this knowledge gap, contributing to the advancement of AWJ technology.

Key Expected Outcomes:

I expect the results of my research to provide valuable insights into the relationships between machining parameters, wear mechanisms, and microstructural changes in difficult-to-machine metal alloys. This will enable a deeper understanding of the processes occurring during the interaction of the abrasive waterjet with the machined material. These findings can help develop optimization guidelines for AWJ processes, improving the efficiency, reliability, and durability of machined components in various industries.