UNIVERSITY COLLEGE DUBLIN

MNMT-DUBLIN

Surface Integrity of Orthopaedic Implants by Grinding

Background

Cobalt Chrome Molybdenum (CoCrMo) alloy has been widely employed in biomedical field as surgical implants. However, wear debris and ion release become an intense issue causing high failure rate of implants. High machined surface integrity is a key approach to solve the problem. The features of poor thermal conductivity and high strength make it categorized as difficult to cut metallic material. Therefore, development on the grinding surface integrity of CoCrMo alloys is particularly essential to prolong the lifetime and enhance the functional performance of surgical implants.

Industrial demands

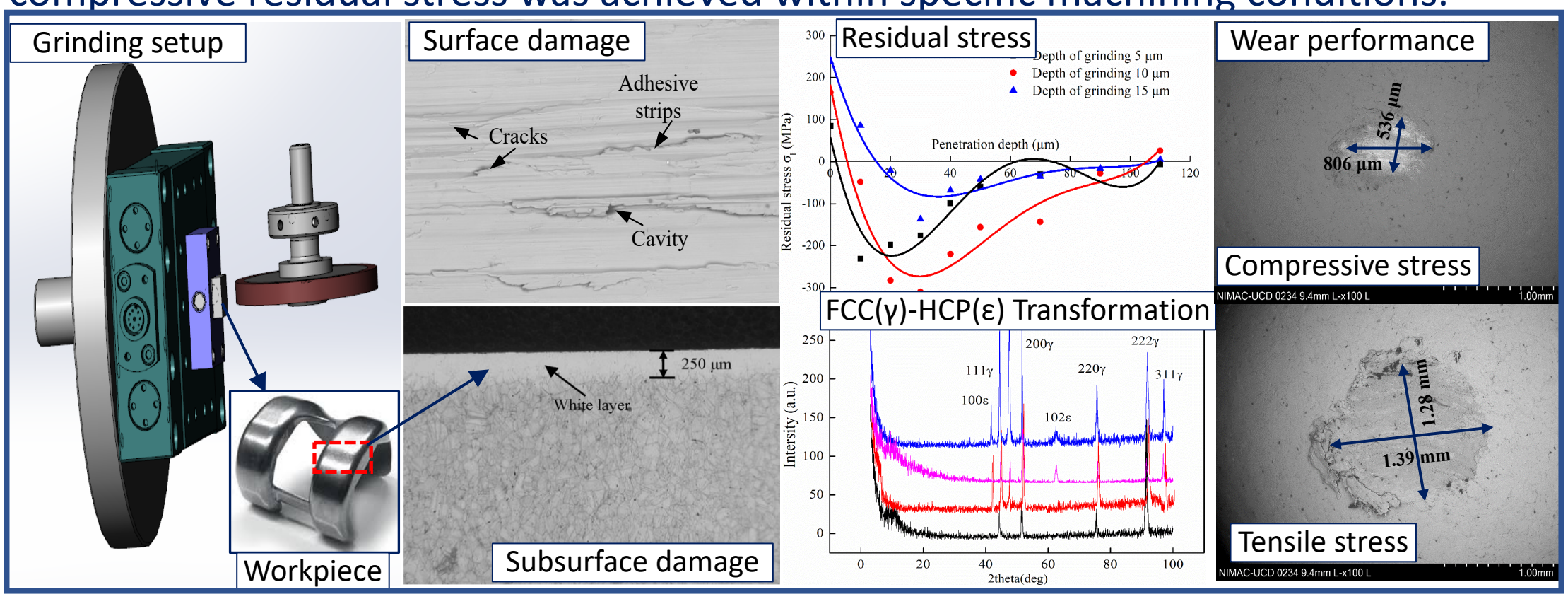
The surgical implant is expected to have the smoothest bearing surface and less processing time, ensuring its safety and long functionality in the body while reducing the cost. The minimum subsurface damage with optional compressive stress is also needed to improve the fatigue strength, wear and stress corrosion resistance.

Approach

Precision multi-axis grinder was employed in machining CoCrMo alloys. Glancing incident X-Ray diffraction was adopted to analyse the stress distribution along the subsurface layer of grounded CoCrMo alloys.

Progress and results

Phase transformation, thermal and mechanical load effects on the residual stress of grinding CoCrMo alloy has been investigated with finite element analysis and experimental tests. The threshold temperature for the compressive-tensile stress transition of grinding CoCrMo was studied. An improved surface layer of compressive residual stress was achieved within specific machining conditions.



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