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Investigation on Electrochemical Mechanical Polishing: Review

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Abstract*:* The complex process of electropolishing involves both electrical and chemical reaction, and it is impacted by a number of process variables, including workpiece rotation, temperature, electrolyte types, and current densi-ty. The electropolishing process remains largely unexplained by any existing theory, particularly in light of recent improvements that have made the material removal mechanism increasingly difficult to comprehend. In order to provide readers with a brief understanding of the material removal mechanism, this paper reviews the fundamental theories and aspects of electricity and chemical reaction. A variety of process factors, including current density, temperature, and electrolyte types reviewed by different researchers, influence the mechanism. Lastly, an overview of the electropolishing technique's development is given as a resource for further study.

Keywords: *ECMP-Electrochemical mechanical polishing, EP-Electro polishing, IEG-Inter electrode gap, ECF-Electrochemical finishing, MNM-Micro nano machining.*

1. Introduction

The technique of improving a part's surface polishing and performance by making it more corrosion resistant is known as electrochemical mechanical polishing. Process is widely used to finish parts in a variety of sectors, including complicated surfaces, die and mold manufacture, and small components utilized in a wide range of applications.

Metal components undergo electro polishing procedures when they are immersed in a chemical bath. This chemical bath is powered by a power supply that changes the AC voltages to DC after the pieces are submerged. The counter electrode is a very smooth tool electrode, and the metal or alloy work piece is biased at a positive potential. In order to remove metal ions from the bath, a viscous acid is utilized as the electrolyte in this process.

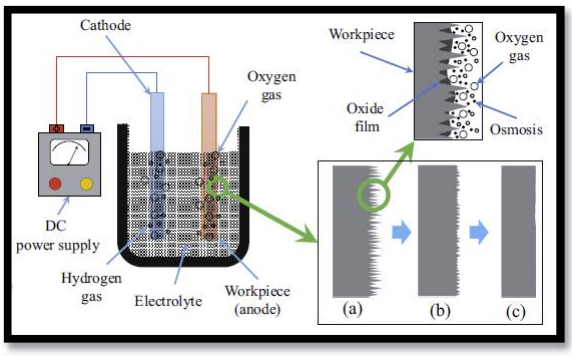

Fig.1 the basic principles of ECP: (a) original surface, (b) after polishing starts and (c) final surface [14]

The metal ions are driven to dissolve from the anode (work piece) surface by the electrical charge generated when the DC power source is turned on. The anode's surfaces are covered with a thin, passive layer of a high-specific-gravity metallic oxide throughout the operation. As seen in Figure 1, this film has different thicknesses throughout its surface, with the thickest areas over micro-depressions and valleys and the thinnest areas over micro-projections and peaks.

2. Mechanical Forces for Finishing In Electrochemical Process

Due to the low material removal rate associated with electropolishing, some surface roughness and scratches are visible, and the material removal process leaves surface pits. The compound method of electrochemical mechanical polishing can be used to get around these flaws. The mechanical action speeds up the anodic smoothing process and raises the removal rate in the anode surface's high spot region. While mechanical abrasion is kept to a minimum,

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