Mirror Surface Polishing of Metallic Pipes by A Novel Natural Fiber Coated Magnetic Tool

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High-quality internal surfaces are critical in aerospace, medical devices, and precision engineering industries. Internal polishing is generally employed to enhance the performance and longevity of such surfaces by minimizing friction, wear and corrosion. This study presents significant advancements in magnetically driven internal finishing (MDIF) technology, specifically targeting the internal polishing of 316L stainless steel tubes. An innovative method employs magnetic balls coated with natural fibers, including wool, cashmere, and silk, to achieve a more flexible and effective polishing process compared to the existing MDIF methods. By integrating alumina abrasive slurry which adheres to the fibers, this method facilitates abrasion action during polishing, resulting in a remarkable improvement of the surface quality. Through iterative development, various materials for the magnetic ball coating were evaluated: porous silicone, which proved inefficient; flocking, which enhanced polishing efficiency but had limited durability; and natural fibers, which provided an optimal balance of efficiency and longevity, achieving surface roughness below 50 nm Ra. The proposed method expands the boundary of MDIF techniques and may find potential applications in semiconductor and optical industries.

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