

Title : Plasma Technology for Surface Preparation of Silver to Improve Electroplating Efficiency

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ABSTRACT

Silver is one of the important precious metals in the jewelry industry. In silver jewelry production, electroplating with other metals, such as gold, rhodium, platinum, is commonly applied to protect the jewelry from scratches and tarnishing caused by sulfur in the air reacts with silver and forms silver sulfide (Ag_2S). Before the electroplating process, the silver surface must be prepared to remove contamination, such as oxide layers, dust, and organic matter. This ensures a smooth surface without pinholes or scratches after being electroplated. Usually, manufacturers use hazardous chemicals, such as sulfuric acid (H_2SO_4) to get rid of the contamination. However, plasma technology can safely clean and prepare the surfaces and has potential to replace the chemical process. In this study, experiments were conducted to determine the most suitable period to treat by plasma, by comparing between two periods of time, which were 5 minutes and 20 minutes using low-temperature vacuum Inductively Coupled Plasma (ICP) system at a power of 100 watts to ionize argon (Ar) gas. By comparing silver surfaces, contact angle, and chemical composition, before and after platinum electroplating, the 5-minute condition gave the best results, as it did not cause any damage to the surface. However, the average contact angle also decreased from 93.11 degrees to 33.51 degrees, which is a 64% reduction, suggesting hydrophilic properties

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which is suitable for electroplating. Platinum content also increased from 0.02% to 0.17%, meaning that the platinum coating was on the surface. After experimenting with the silver plates applied by hydrogen sulfide (H₂S) to compare between plasma-prepared and chemical-prepared samples and measure the changes in color and lightness via CIE L*a*b*, the results showed that both silver plates had comparable tarnish resistance. In conclusion, using 5 minutes of plasma treatment to prepare the metal surface before electroplating has comparable efficiency to traditional preparation methods. It also reduces risks to users and prevents environmental damage.

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